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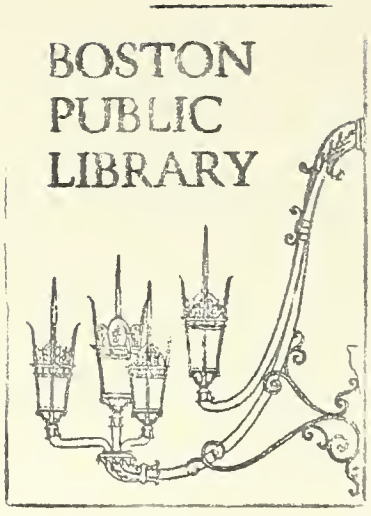
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TRANSPORTATION ACCESS PLAN

FOR

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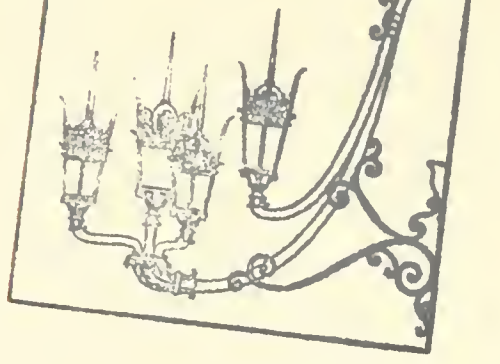

TRANSPORTATION ACCESS PLAN

for a

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New England Deaconess Hospital
New Clinical Facility

prepared for

The New England Deaconess Hospital
185 Pilgrim Road
Boston, Massachusetts 02215

prepared by

Abend Associates
304 Concord Road
Wayland, Massachusetts 01778

617-358-7095

September 18, 1987

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ABEND ASSOCIATES
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304 Concord Road, Wayland, Massachusetts 01778
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Introduction

The New England Deaconess Hospital (NEDH) proposes to make major changes to its hospital facility located in the Longwood medical area of Boston. The primary function of the proposed construction is to respond to changing health care demands by the public and will involve primarily the redeployment of hospital facilities. The project does not involve a significant increase in the square footage of the hospital or in its employment level but, rather, involves a change in the focus and arrangement of existing hospital facilities.

Program Changes - Specifically, the project will provide the following programmatic changes:

1. Closure of the nursing school.
2. Expansion of ambulatory services.
3. Replacement of administrative office space.
4. Relocation of the hospital entrance and visitor facilities.
5. Relocation of existing beds.
6. Enlargement of inpatient facilities to relieve existing overcrowding.

Physical Changes - Specifically, the physical changes to the Deaconess campus currently proposed are as follows:

1. Modifications to the Kennedy Building to convert it from a School of Nursing to an outpatient and ambulatory care facility.
2. Demolition of the Harris Building which is entirely devoted to administrative offices and which is currently overcrowded.
3. Elimination of the doctors' parking lot.

4. Demolition of stores at the corner of Deaconess and Brookline.

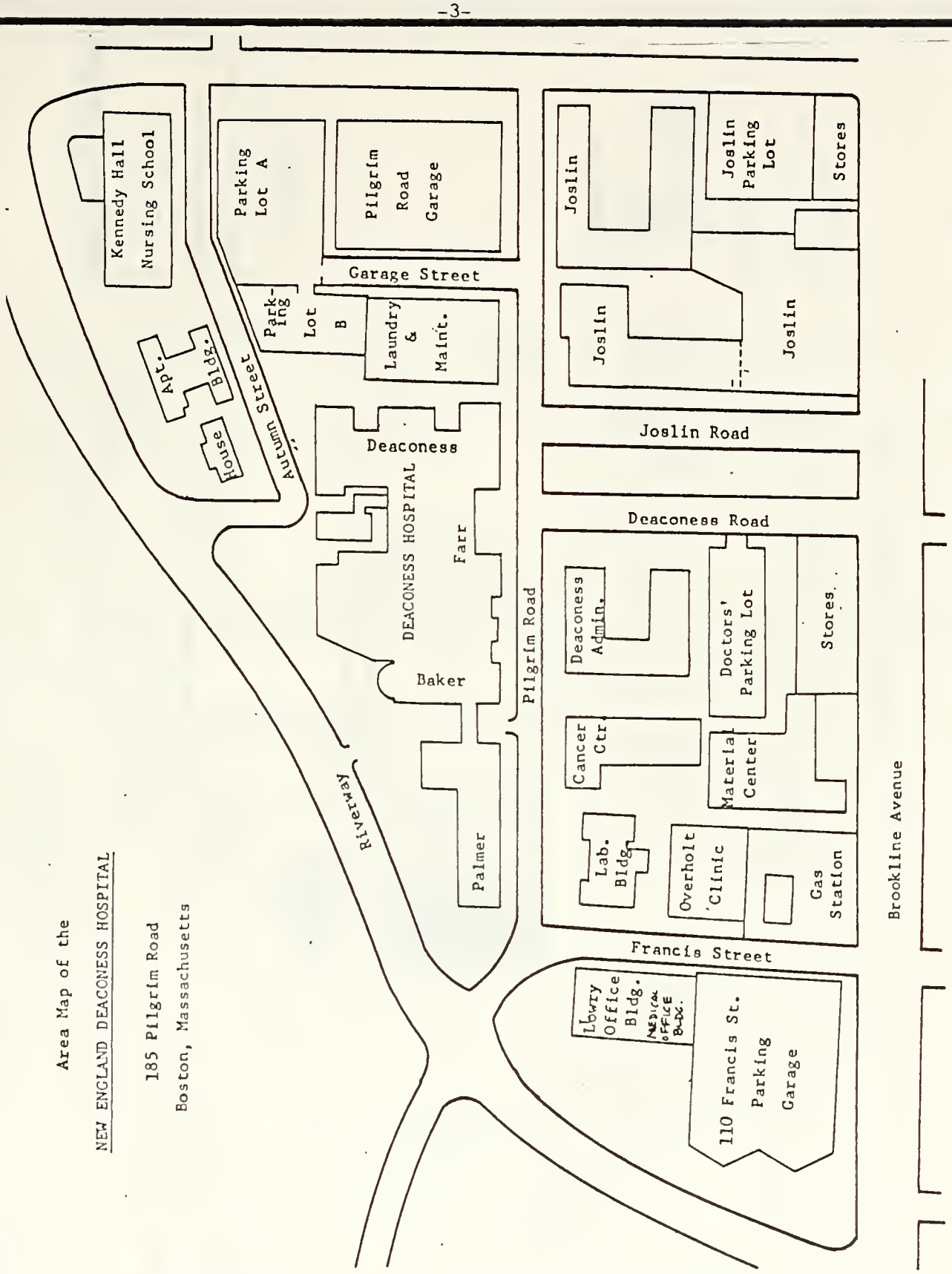
5. Closure of Pilgrim Road to through traffic from Deaconess Road to Francis Street.

The new building, which will be built on Deaconess and which is the only new construction involved in the renovations, will provide several functions, as follows:

USE	AREA
108 Patient Beds and 24 Acute Care Beds	100,000 square feet
Surgical Unit	50,000 square feet
Xray Unit	50,000 square feet
Lobby and Visitor Services and Facilities	25,000 square feet
Basement Area	25,000 square feet
TOTAL	250,000 square feet

The existing Kennedy Building which will be converted from a nursing school to an ambulatory care facility, contains 85,000 square feet which will remain unchanged following renovations and modifications.

Exhibit 1 is an orientation map showing the NEDH area, and Exhibit 2 is a Schematic Site Plan showing the proposed changes. The new building will eliminate the NEDH administration building, stores along Brookline Avenue, the doctors' parking lot, and a portion of the material center which will be relocated off campus to a suburban location. The impacts of this is addressed elsewhere.



ORIENTATION MAP

ABEND ASSOCIATES

EXH. 1

SCHEMATIC SITE PLAN

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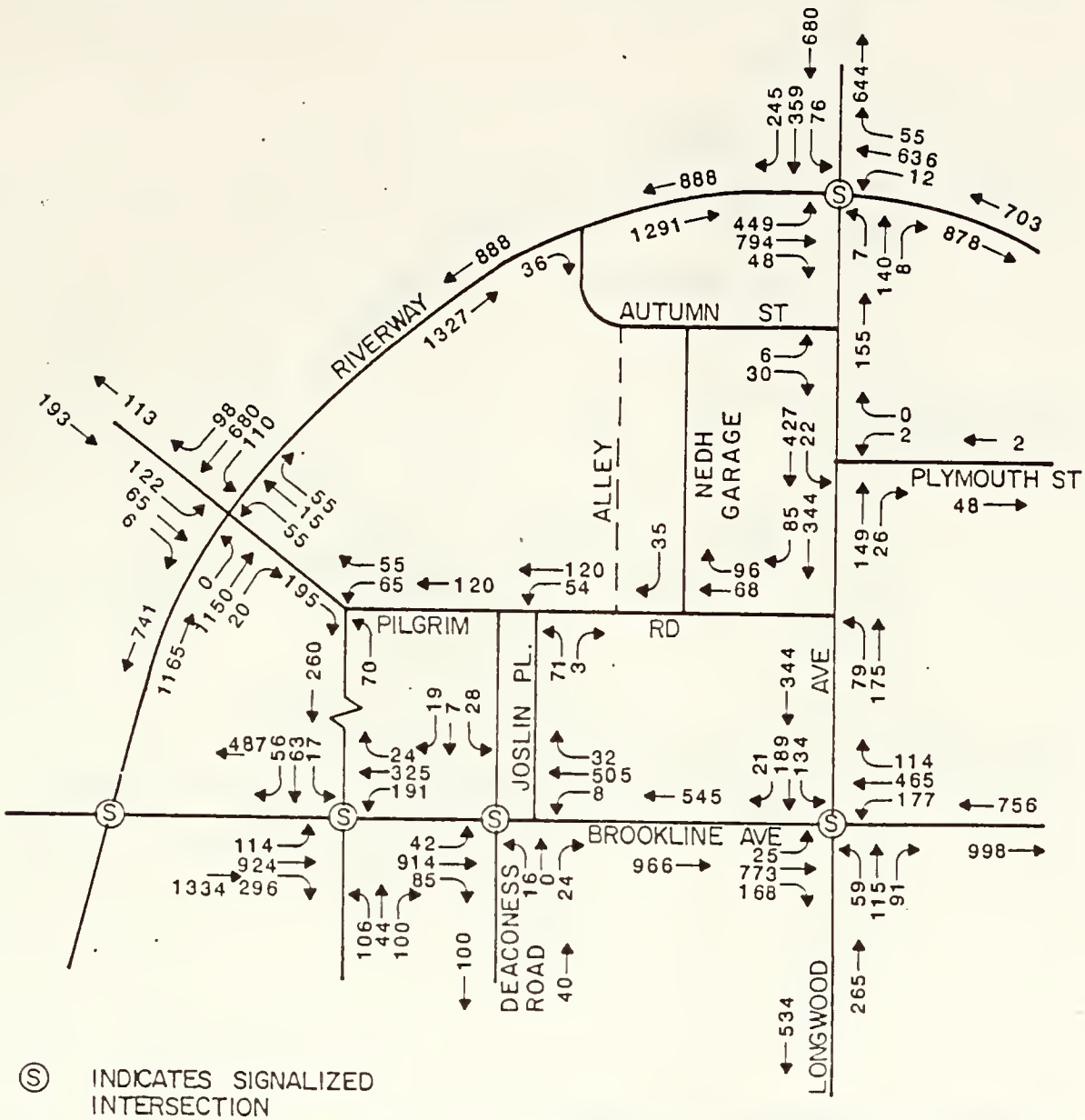
EXH. 2

Existing Conditions and Volumes

The NEDH complex occupies a large triangular area bounded by Brookline Avenue, Longwood Avenue and the Riverway. The orientation map exhibit shows that most of the buildings within that complex are part of the NEDH/Joslin Clinic/110 Francis Street Medical Office Building grouping. Because of this relationship to existing major streets, NEDH appears to have a somewhat better access and circulation system than other parts of the MASCO area.

As a result of the limited size of the campus and its location within major streets, the primary function of the internal street system within the NEDH area is to serve the hospital. The closure of Pilgrim Road between Brookline Avenue and Longwood Avenue several years ago further enhanced the position of internal streets serving local development by eliminating a fairly heavy short-cut movement that traversed the entire length of Pilgrim Road.

Exhibits 3 and 4 show existing morning and evening peak hour volumes on the road system in the NEDH area. These are excerpted from a traffic study done by Vanasse/Hangen Associates in 1986. Exhibit 5 taken from that same report shows the estimated Average Daily Traffic (ADT) for a number of road segments in the NEDH area. These volumes provide a basis for evaluating the impact of the project, in terms of traffic volumes and, especially, in relation to the proposed discontinuance of Pilgrim Road between Deaconess Road and Francis Street.



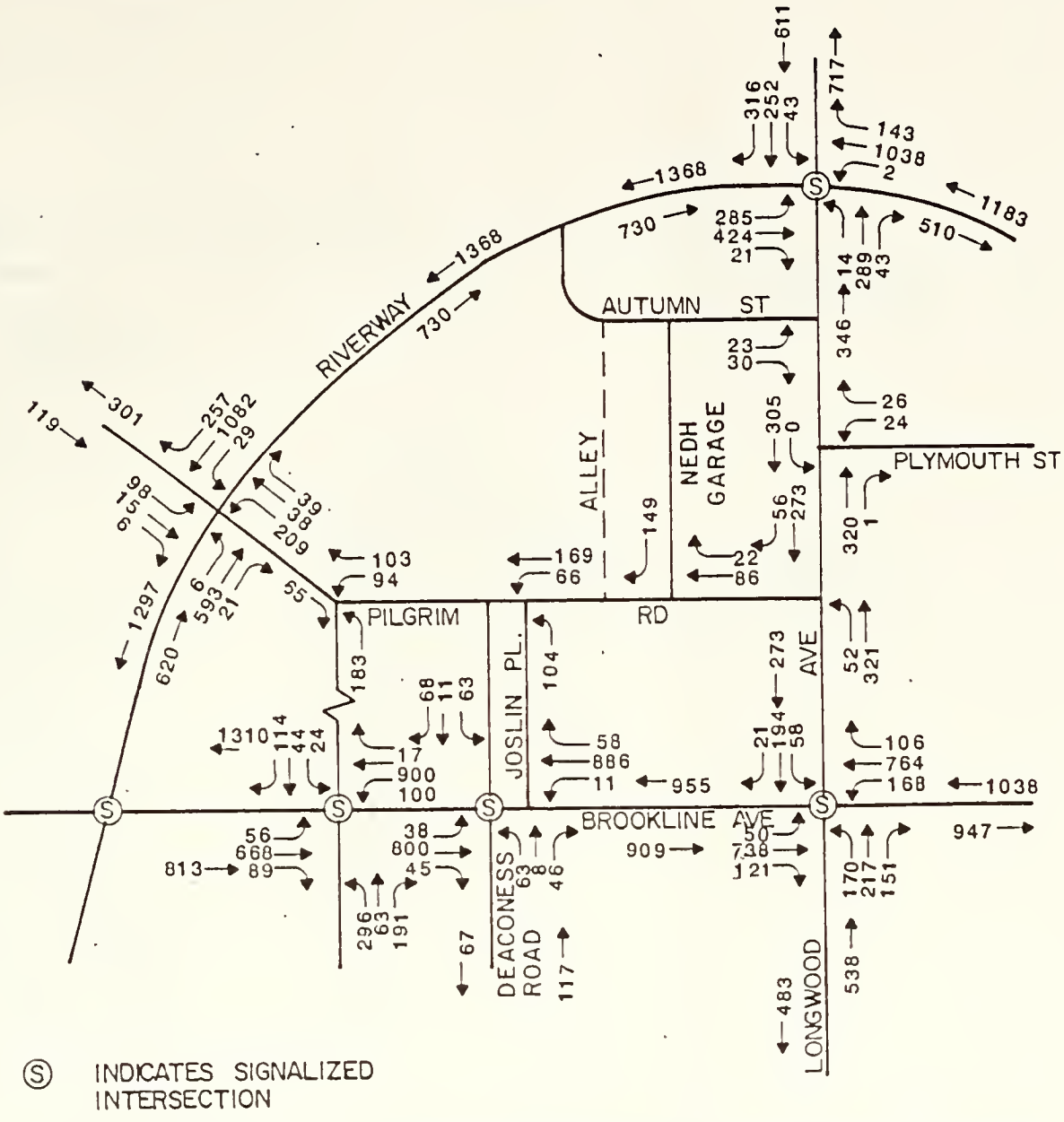
NOTE: Based primarily on volumes measured 4/85 and 5/86

Existing A.M. Peak Period Volumes

Vanasse/Hangen
Consulting Engineers & Planners
60 Birmingham Parkway, Boston, MA 02135

Not to Scale

EXHIBIT 3



NOTE: Based primarily on volumes measured 4/85 and 5/86

Vanasse/Hangen
Consulting Engineers & Planners
60 Burmingham Parkway, Boston, MA 02135

Not to Scale

Existing P.M. Peak Period Volumes

EXHIBIT 4

Memorandum

Date: May 16, 1986
Ref: 1518

Table 2
Daily Traffic Volume summary

Location	ESTIMATED ADT*	AM Peak Hour** Volume	PM Peak Hour** Volume
Pilgrim Road just east of Joslin Place	2,700	177	235
Pilgrim Road east of Francis Street	2,100	120	197
Deaconess Road north of Brookline Avenue	1,300	54	142
Joslin Place north of Brookline Avenue	1,200	74	104
Francis Street between Pilgrim Rd & Riverway	3,700	320	351
Longwood Avenue between Binney & Blackfan Sts.	14,588***	999	1,025
Longwood Avenue between Pilgrim Rd & Brookline Ave.	9,000	598	646
Brookline Avenue north of Longwood Avenue	29,293***	1,754	1,985

* Average Daily Traffic - Estimate based on peak period turn volumes presented in Figures 1 and 2, except where *** indicates a different source.

** AM and PM Peak Volumes are reported from Figures 1 and 2. 7:30-8:30 AM and 4:00-5:00 PM represent the peak volume periods indicated in Figures 1 and 2.

*** September, 1983 data

EXHIBIT 5

Vanasse/Hangen
Consulting Engineers & Planners
60 Burmingham Parkway, Boston, MA 02135
617/783-7000

Trip Generation

The proposed construction and renovation program will not result in the addition of new staff. As noted previously, the entire new building on Deaconess Road involves the relocation of existing overcrowded facilities and replacement of existing square footage on-site. Conversion of the Kennedy Building from a nursing school to an ambulatory care facility will modify its trip generation characteristics. Currently, the school operates on a predominantly 9:00 am to 5:00 pm basis with the bulk of arrivals during the morning peak hour and departures during the evening peak hour. The proposed ambulatory care facility will have slightly different characteristics.

The professional and technical staff of the nursing school will be replaced by a staff with different skills servicing the ambulatory care facility. There will obviously be the elimination of students, many of whom commute during the peak hours. Replacing peak hour traffic will be patient arrivals for outpatient care. The current projection for the Kennedy Building is for the treatment of 100 patients per day.

Experience at other ambulatory care facilities at NEDH shows that most of this activity occurs between 10:00 am and 3:00 pm, during which time background traffic volumes are lower. Assuming a uniform patient arrival/departure rate, particularly since most visits are scheduled, it is expected that on the average, there would be about 20 patients per hour. Based on previous studies of outpatients in the area, no reductions in trip generation have been made for walk-in, public transit, or "carpooling." These alternate modes are shown to constitute only about 15 percent of outpatient visits.

Thus, the hourly generation rates for the new generation will occur during the middle part of the day and this volume is expected to be 20 inbound and 20 outbound trips per hour between 10:00 am and 3:00 pm. The project is not expected to have any impact on peak hour trips.

In terms of peak hour traffic, the conversion of the Kennedy Building should result in a reduction in peak hour trips for the following reasons:

1. NEDH will set aside about 20 spaces in the Pilgrim Road garage for use by outpatients. This garage is ideally located directly across the street from the Kennedy Building. This garage is now used primarily by commuters and the set-aside of spaces for midday use will result in a slight reduction in peak hour volumes. As noted elsewhere, these commuter cars will be accommodated off-campus, either at off-site parking lots operated by NEDH or at other locations operated by MASCO. This assumes no change in commuting mode.

2. The trip generation associated with the new building on Deaconess Road is assumed to cause no reduction in trip generation even though a doctors' parking lot will be removed. As yet, the hospital is undecided as to whether these spaces will be replaced at a nearby location or whether they will be put into the garage. This would result in a further reduction in commuter spaces and another slight reduction in peak hour travel associated with NEDH.

A summary of the major components of the project and their effect on trip generation follows:

* 108 Project Beds (75,000 sq. ft.)	A one-for-one replacement of beds to relieve overcrowding in existing buildings - No change in trip generation.
* 24 Acute Care Beds (25,000 sq. ft.)	A one-for-one relocation of existing beds - No change in trip generation.
* Surgical Unit (50,000 sq. ft.)	Replacement and enlargement of existing facilities - No change in trip generation.
* Lobby and Visitor Facilities	Relocation and enlargement, but no change in number of hospital beds - No change in trip generation.
* Basement Area (25,000 sq. ft.)	Storage area - No trip generation.
* Removal of Doctors' Parking (50 spaces)	Displacement of commuter spaces by replacement of these spaces will result in a reduction of peak hour trips - Slight net reduction in peak hour trips.

* Removal of Harris Hall (52,000 sq. ft.)	Offices will be relocated elsewhere in hospital - No increase in employment - No change in trip generation.
* Nursing School Conversion	Use of building for outpatients will increase midday trips, but peak hour trips will stay constant since projected staffing of buildings is equal to existing staffing of nursing school - No change in peak hour trip generation.

In sum, the project is not expected to generate any additional traffic during peak hours. There will be a slight increase in off-peak trip generation which will be offset by reductions at other times of the day, especially during the commuter peaks.

Pilgrim Road Closure

The loss of Pilgrim Road between Deaconess Road and Francis Street would affect the travel pattern of about 100 vehicles during the morning peak hour and about 180 vehicles during the evening peak hour. The effect of the traffic pattern change is discussed below.

Exhibits 6 and 7 show the existing morning and evening peak hour volumes at the Pilgrim Road/Francis Street intersection and the likely diversion of this traffic. Exhibit 8 provides an estimated breakdown of traffic now using the street.

Deaconess Road will probably be most affected by the discontinuance. Most vehicles now using Pilgrim Road to reach Francis Street eastbound would be diverted to Deaconess Road. However, the street can easily accommodate the added traffic of about 60 cars in the morning and about 90 cars in the evening. This might benefit Francis Street operations which include the front door activities at 110 Francis Street Medical Building and garage.

Diversions are also expected onto Autumn Street. Some Pilgrim Road garage trips that now use Pilgrim Road to reach the Riverway will opt for a routing via Autumn and Longwood. A routing along Garage Road and Autumn Street provides a comparable routing from the garage to the Riverway southbound. (Although Autumn Street is signed as a one-way at Longwood, the left turn from Garage Road to Autumn Street is not prohibited by signing.)

The before and after diagrams shown in Exhibits 9, 10, 11, 12, 13, and 14 indicate how movements now using Pilgrim Road will be changed. Also shown in the diagrams are the estimated morning and evening volumes associated with each identified movement.

As the diagrams show, the change in traffic pattern does not result in any large increases in volumes at the three major intersections defining

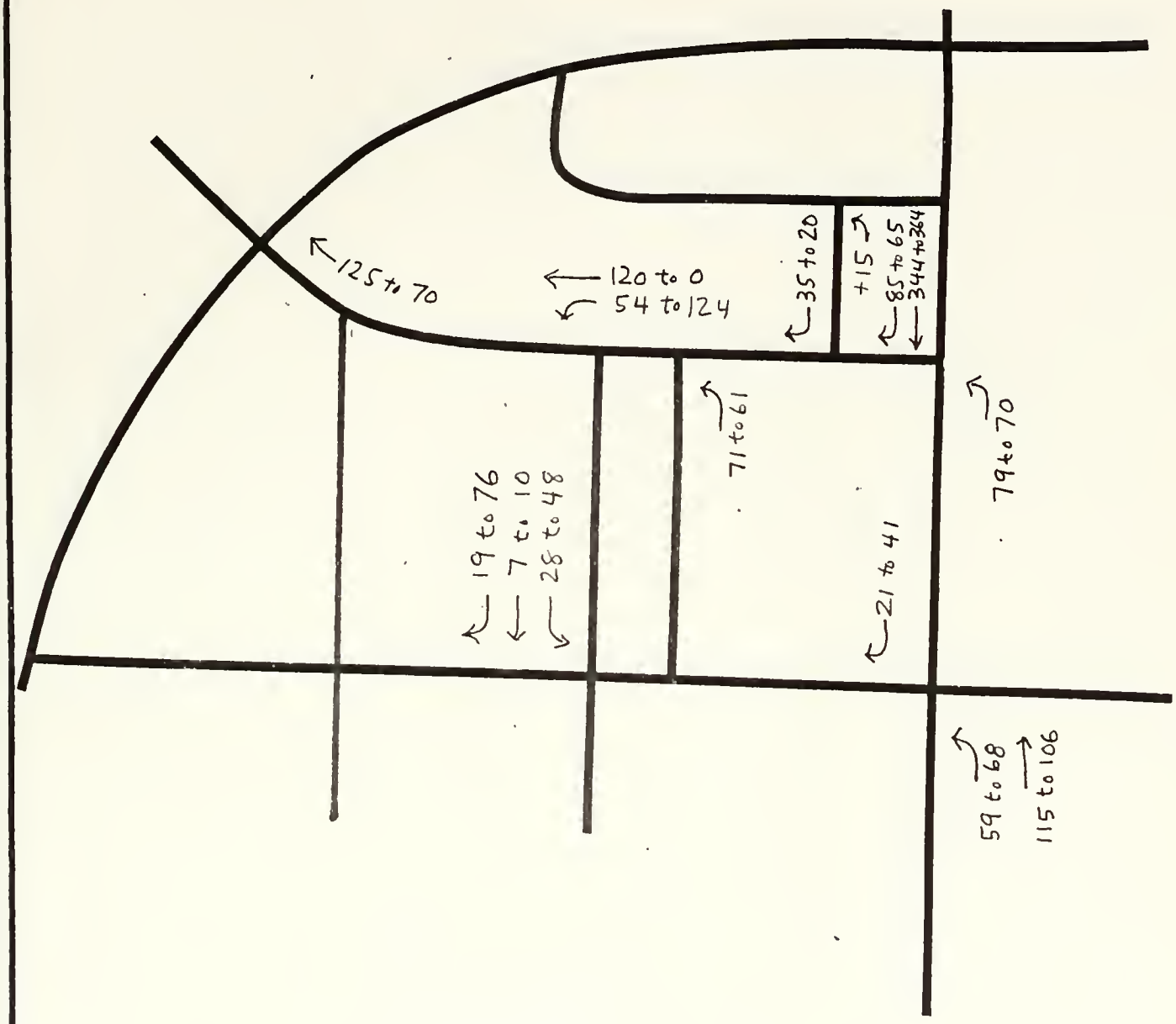
the corners of the NEDH "triangle." In many instances, traffic on Pilgrim Road already goes through one of the key intersections. Thus, the reduction in volume on the proposed discontinued section of Pilgrim Road will not necessarily result in an equivalent volume of traffic added to Brookline Avenue or the Riverway, the two parallel roads to Pilgrim Road.

It is important to note that regardless of which route is chosen, traffic entering and/or leaving the NEDH triangle must travel through one of the corner intersections. The closure of Pilgrim Road will not change this.

Given the opportunities that exist for alternate routings, the relatively small number of trips involved, and the traffic pattern in the area, the loss of circulation on Pilgrim Road as proposed should not result in any major change in overall circulation or in the traffic operations of any existing intersection.

The diversion of this traffic will not have the effect of overloading existing intersections. The large local orientation of Pilgrim Road traffic and the alternate route options will result in adjustments in volume that are small overall and even smaller at any single location.

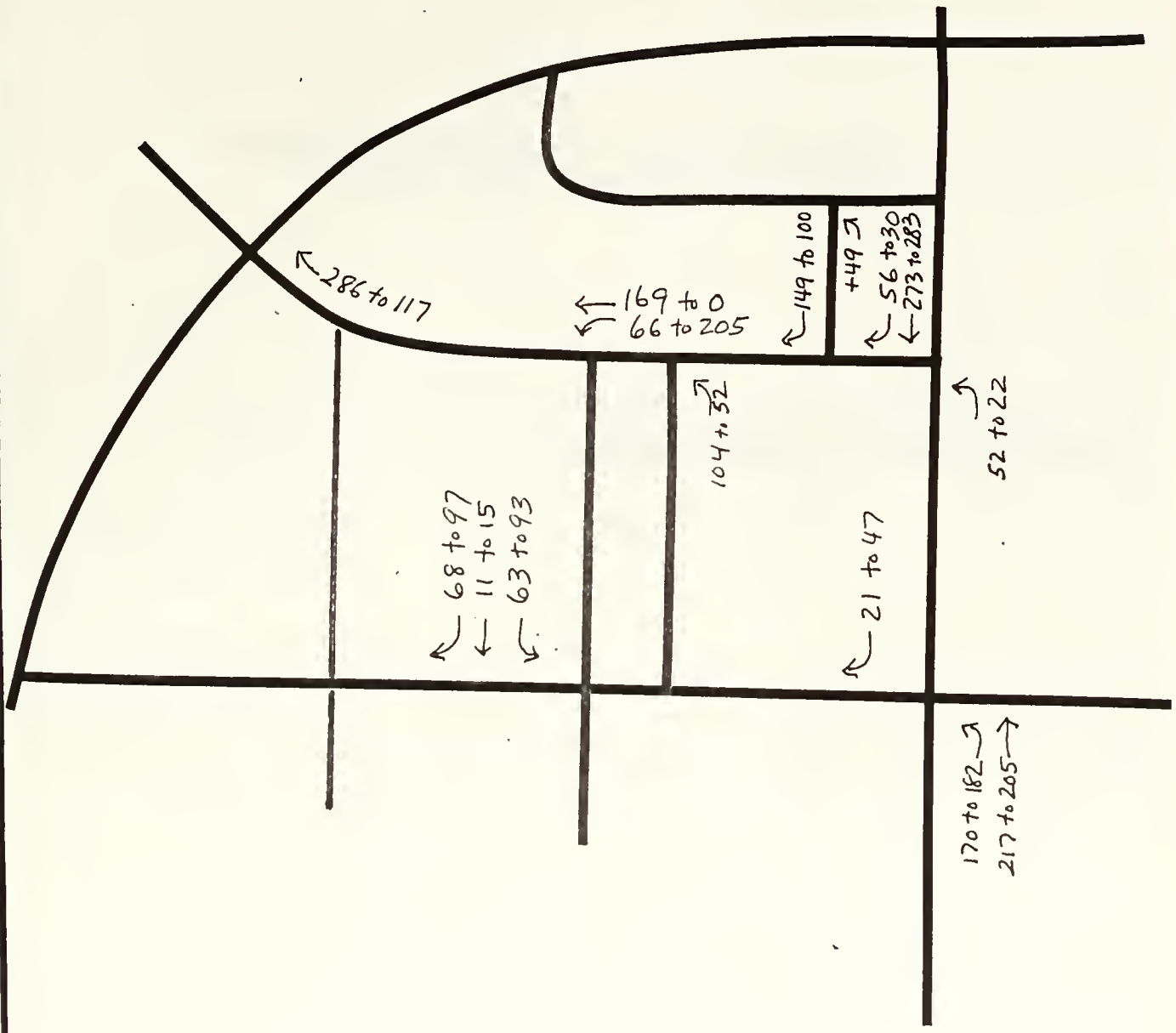
The table shown in Exhibit 15 provides a summary of Delay and Level of Service for the intersections most affected by the closure of Pilgrim Road. The delay and capacity calculations are shown in the appendix. The change in volumes is based on the traffic pattern/volume analysis described above. The table shows that the projected effect of the closure is very small, and that there are both increases and decreases in delay, depending on the location and time of day. In no case does the Level of Service change as the result of the Pilgrim Road closure. The calculations are shown in the appendix.



PROJECTED TRAFFIC DIVERSION-AM

ABEND ASSOCIATES

EXH 6



PROJECTED TRAFFIC DIVERSION-PM

ABEND ASSOCIATES

EXH 7

ESTIMATED BREAKDOWN OF PILGRIM ROAD TRAFFIC
on Proposed Discontinued Portion of Street

Movement	AM		PM	
	Percent	Number	Percent	Number
To Deaconess Entrance	50	60	20	40
To 110 Francis Street	30	36	15	30
From Pilgrim Road Garage	10	12	45	88
Other and Through Traffic	10	12	20	40

PILGRIM RD. TRAFFIC COMPOSITION

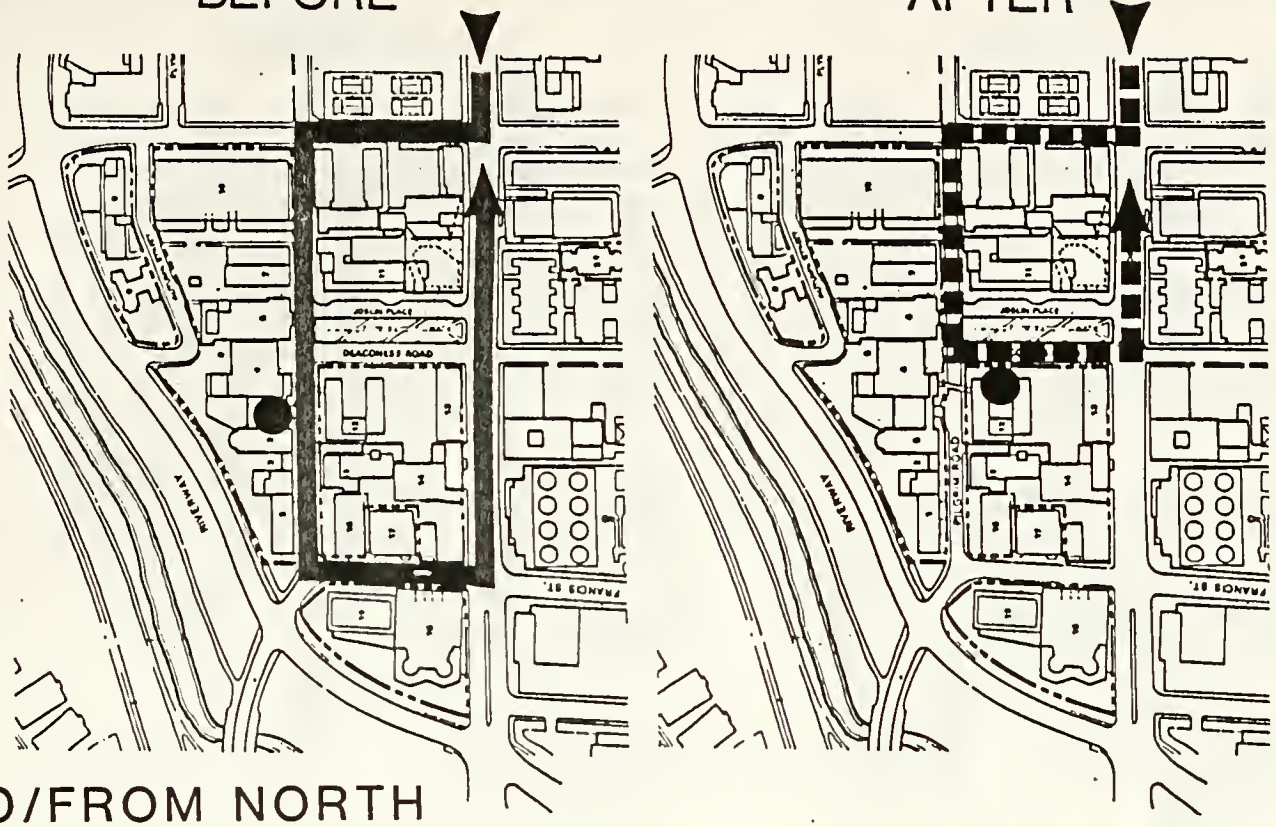
ABEND ASSOCIATES

EXH. 8

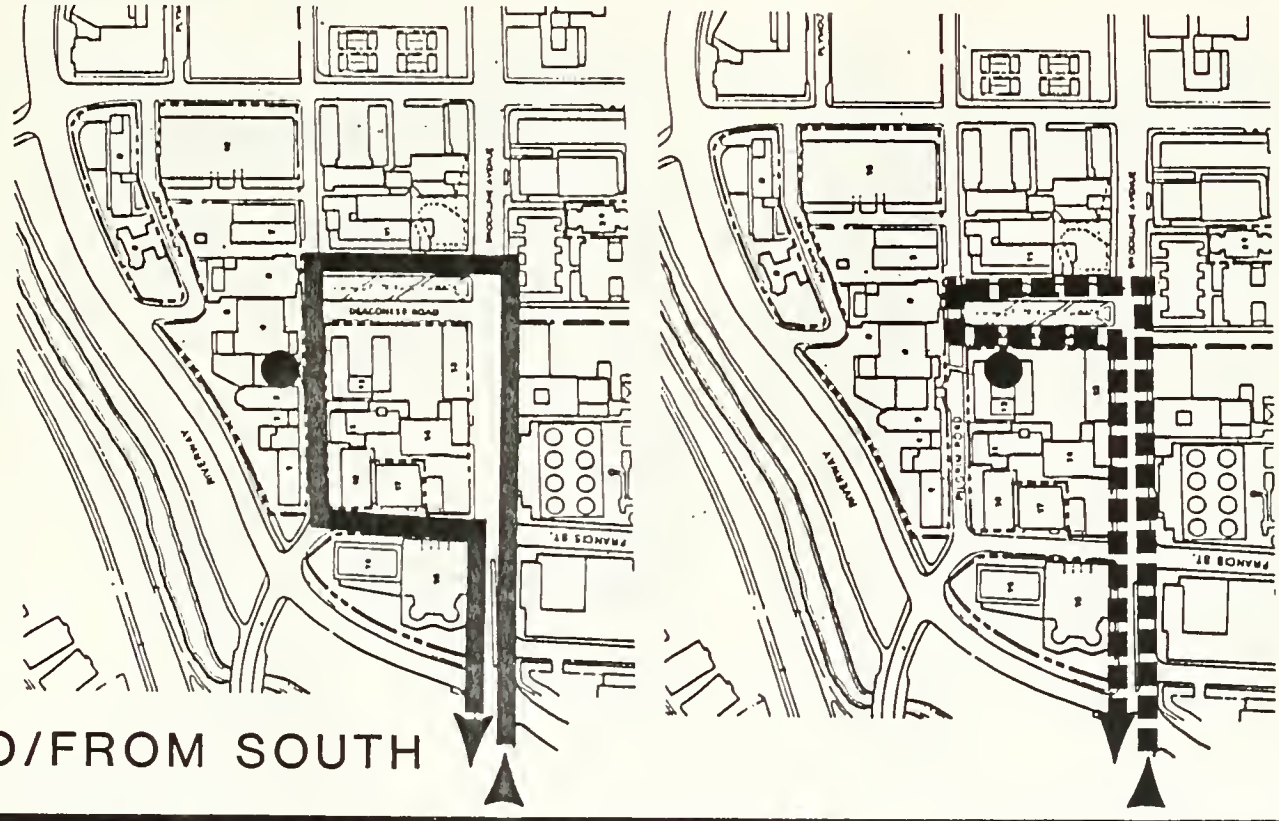
am-60 pm-40

BEFORE

AFTER



TO/FROM NORTH



TO/FROM SOUTH

TRAFFIC PATTERN

TO/FROM DEACONESS ENTRANCE

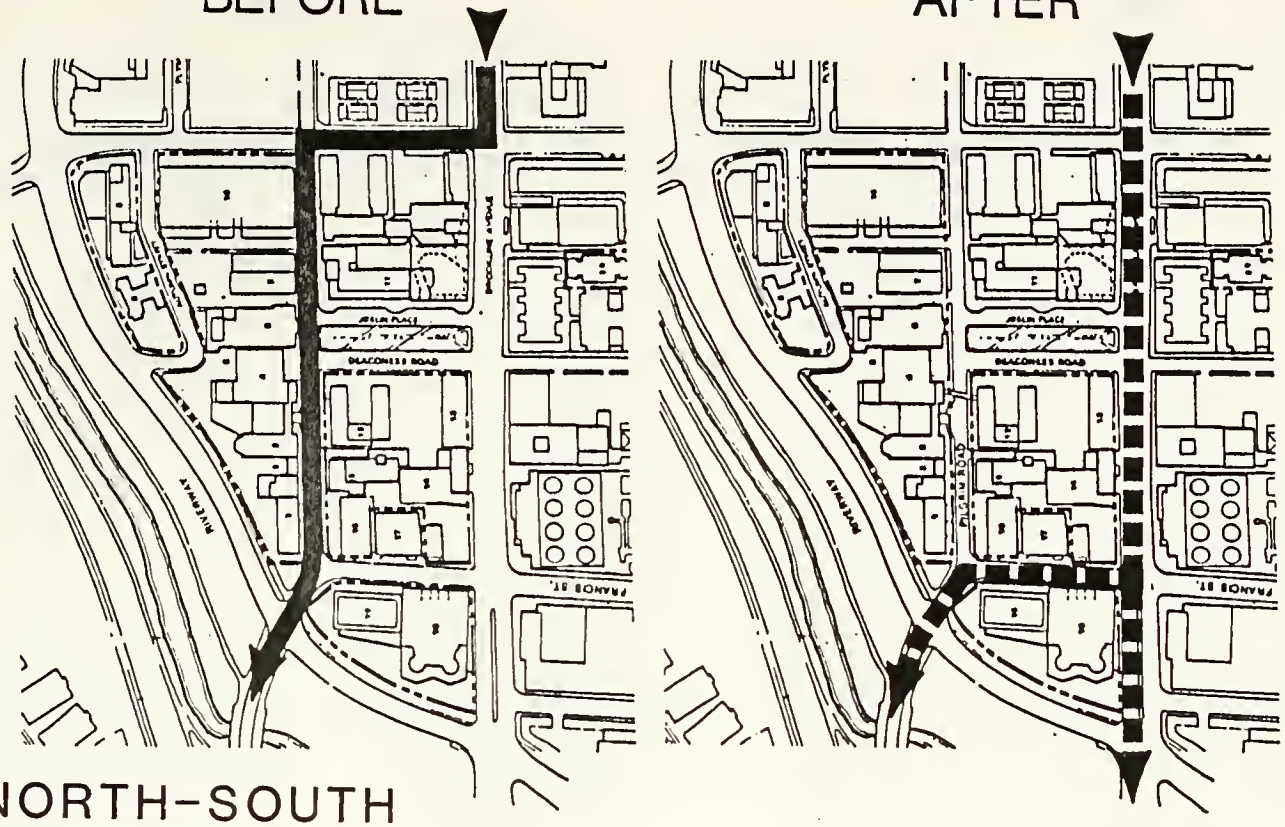
ABEND ASSOCIATES

EXH. 9

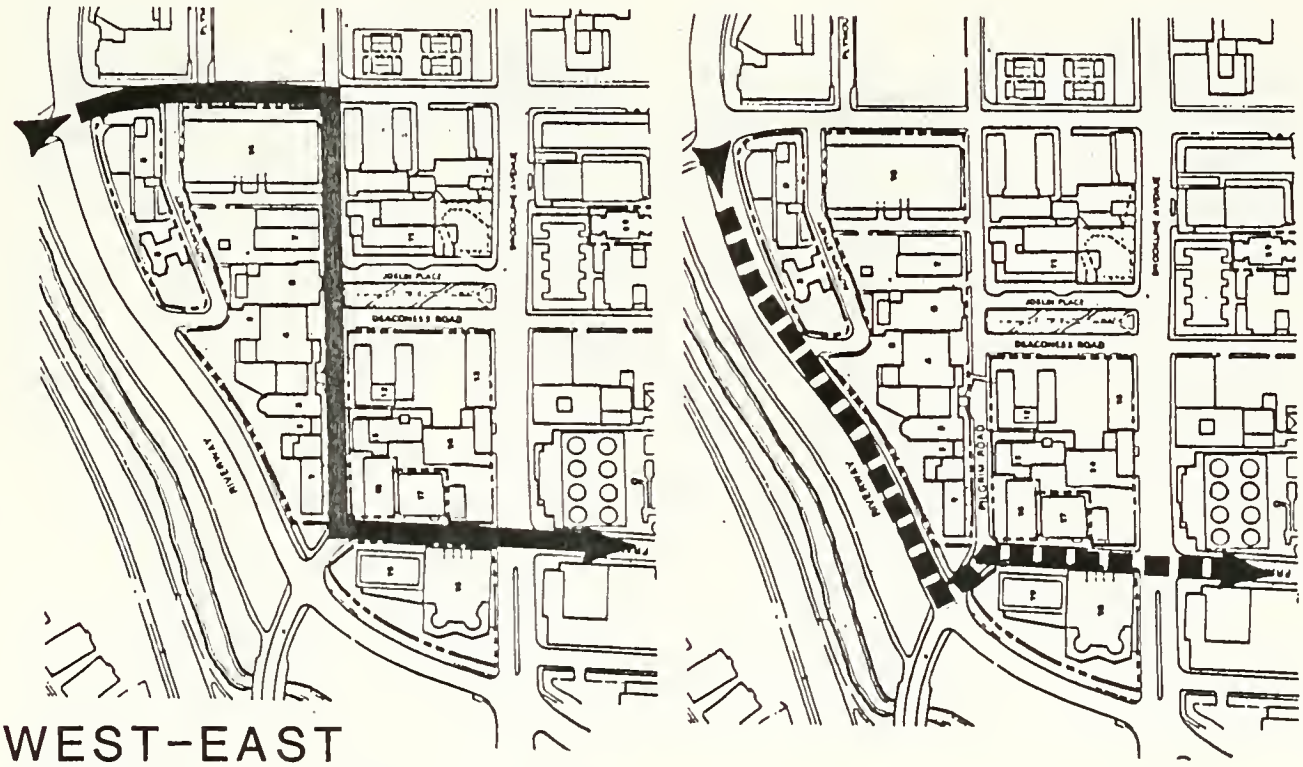
am-12 pm-40

BEFORE

AFTER



NORTH-SOUTH



WEST-EAST

TRAFFIC PATTERN

THROUGH TRAFFIC

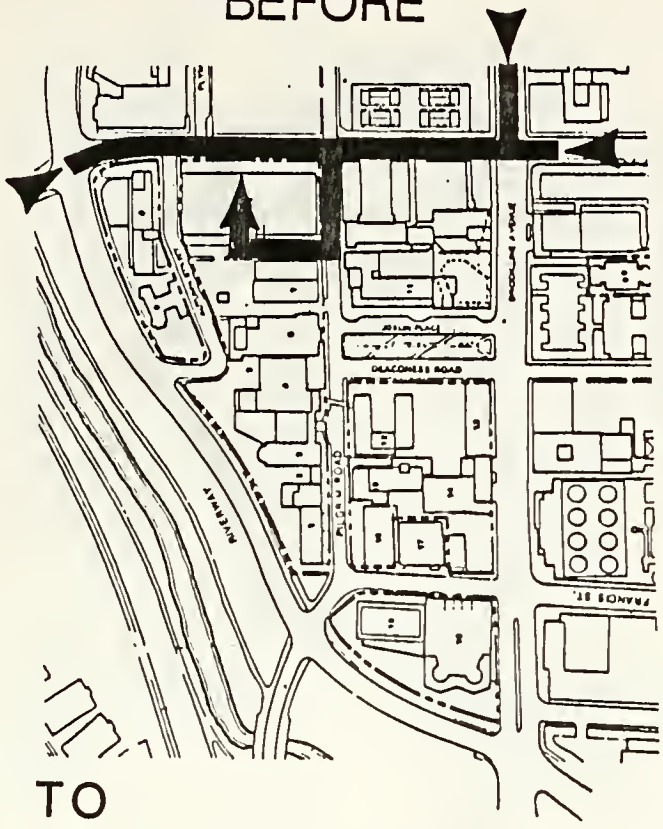
ABEND ASSOCIATES

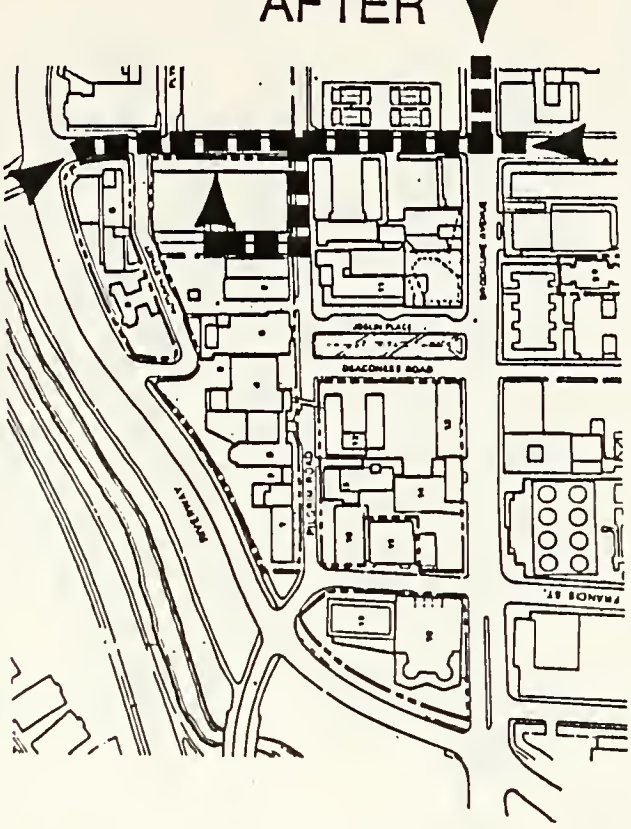
EXH. 10

am-50 pm-88

BEFORE

AFTER





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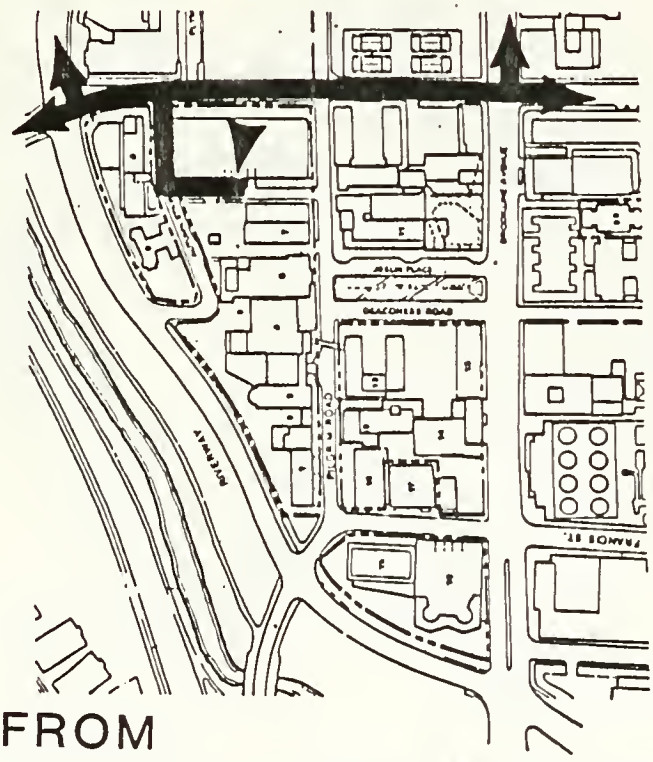
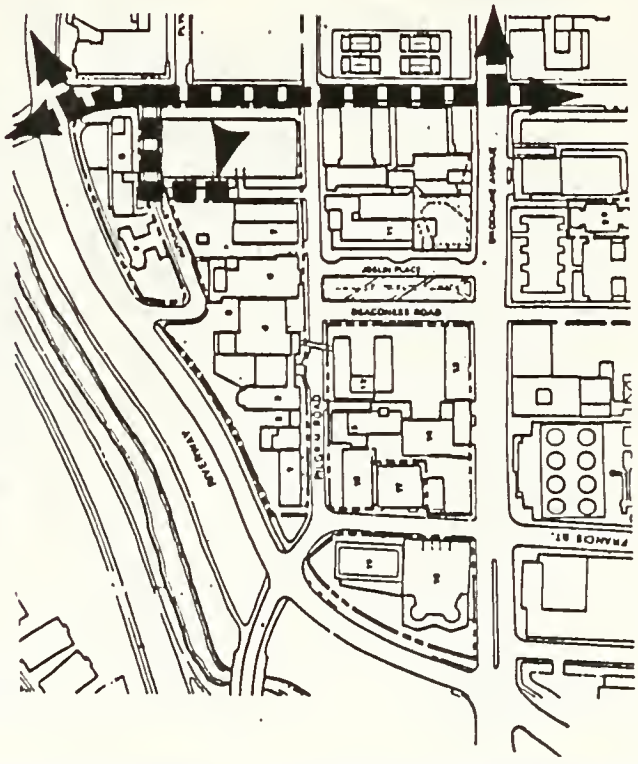




FROM

TRAFFIC PATTERN

TO/FROM PILGRIM RD. GARAGE-NORTH

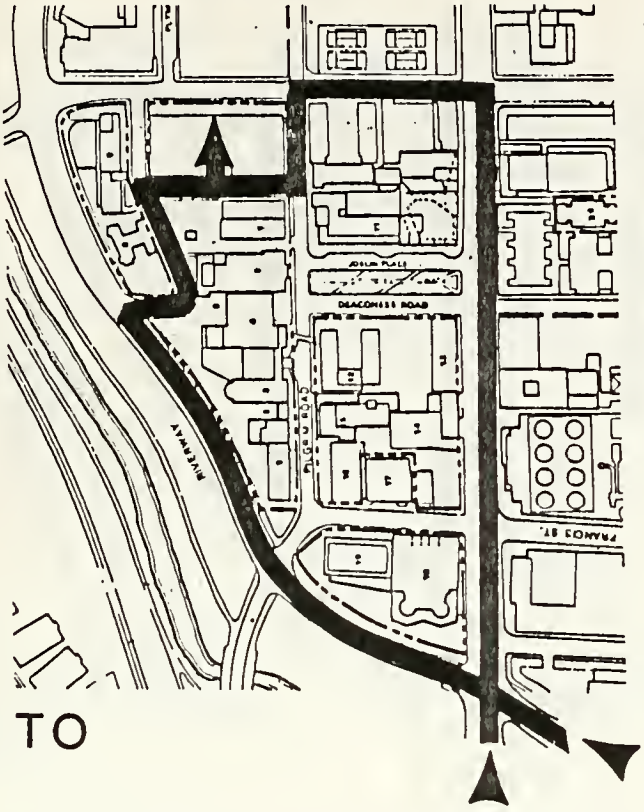
ABEND ASSOCIATES

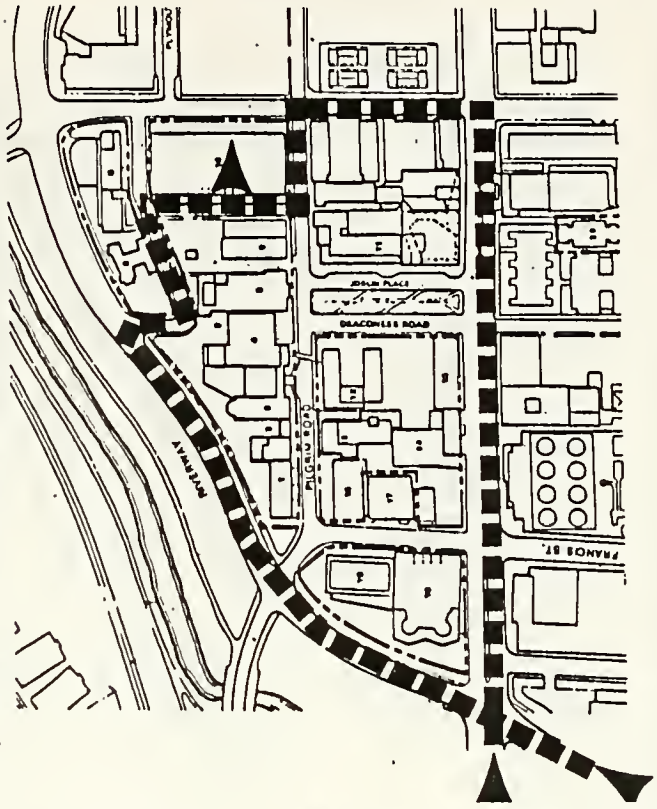
EXH. 11

am-100 pm-100

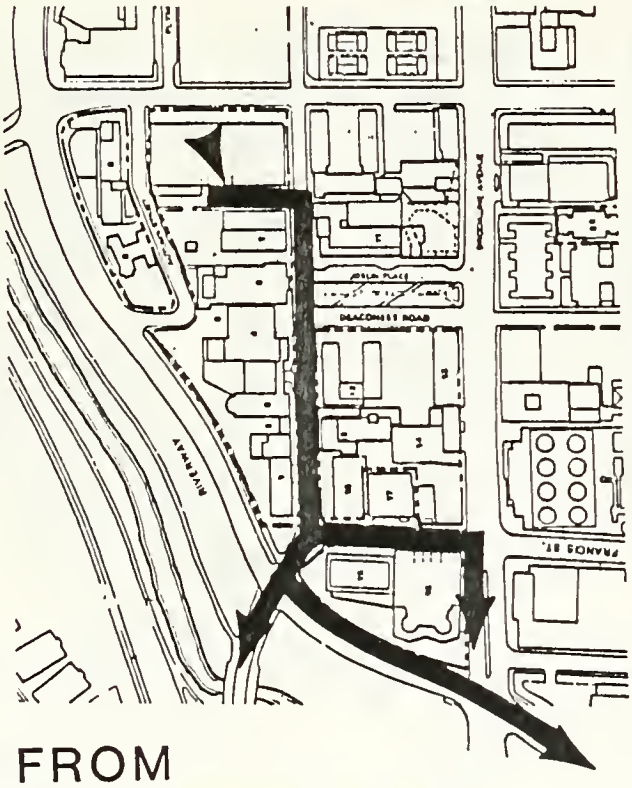
BEFORE

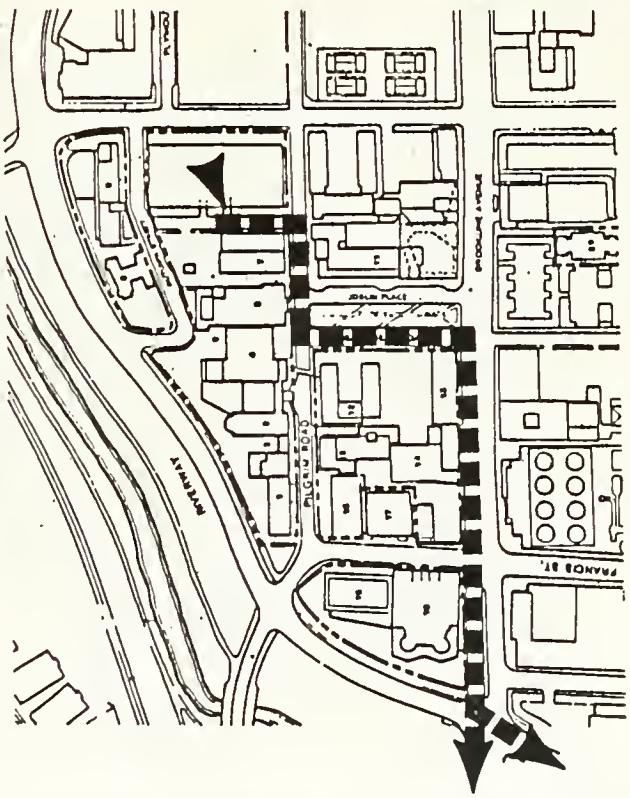
AFTER





TO





FROM

TRAFFIC PATTERN

TO/FROM PILGRIM RD. GARAGE-SOUTH

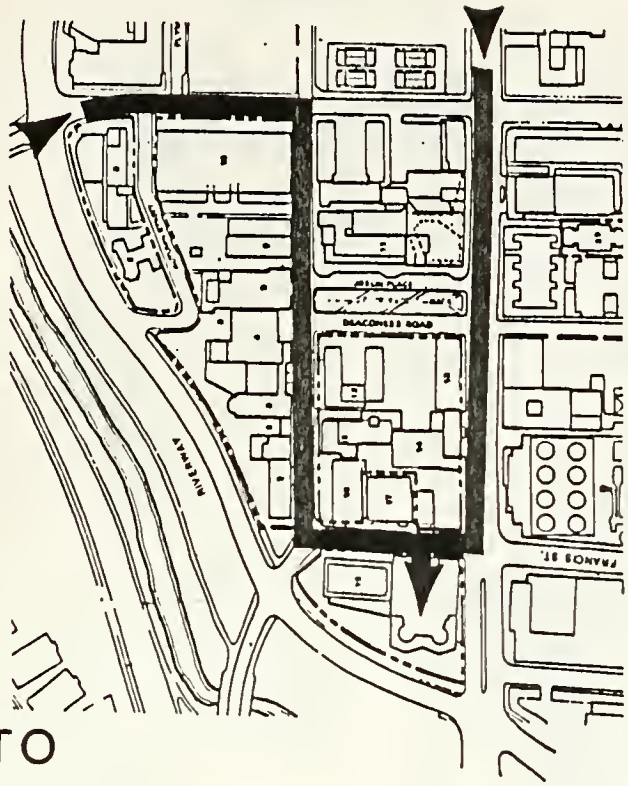
ABEND ASSOCIATES

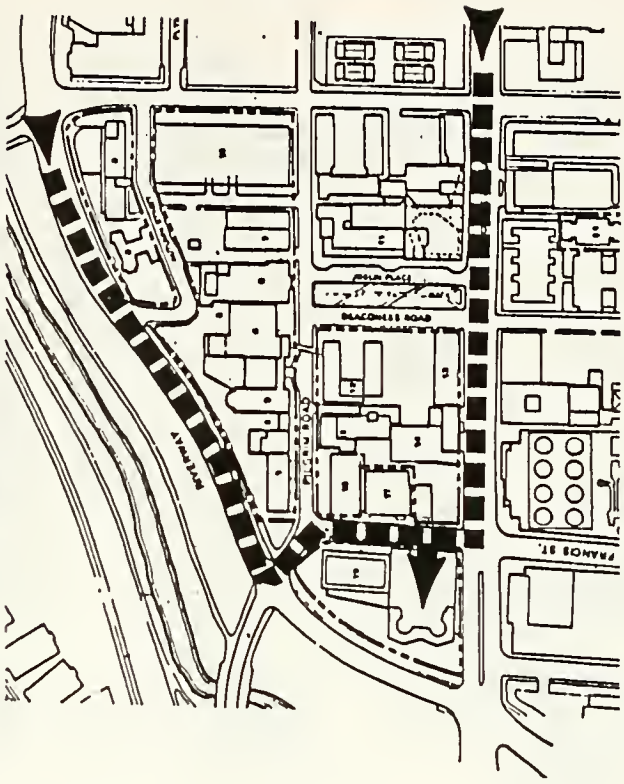
EXH. 12

am-36 pm-30

BEFORE

AFTER





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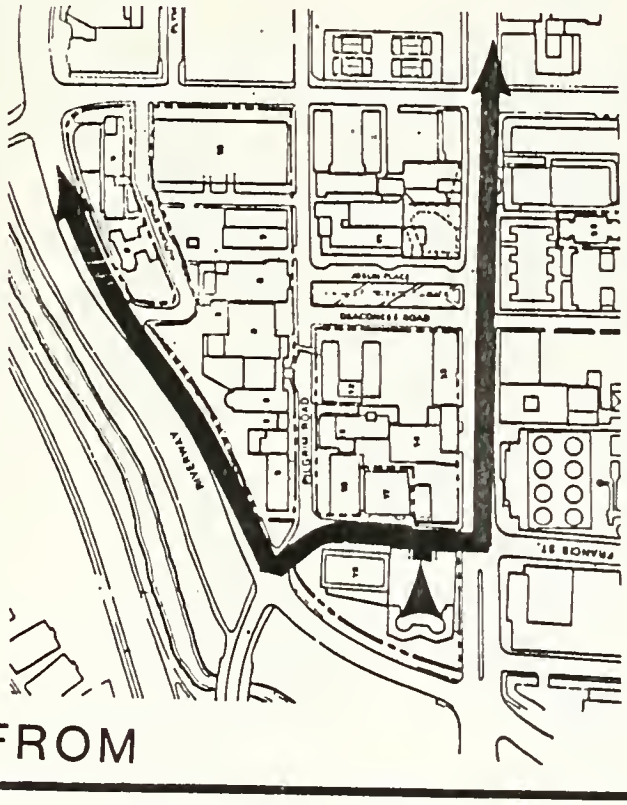
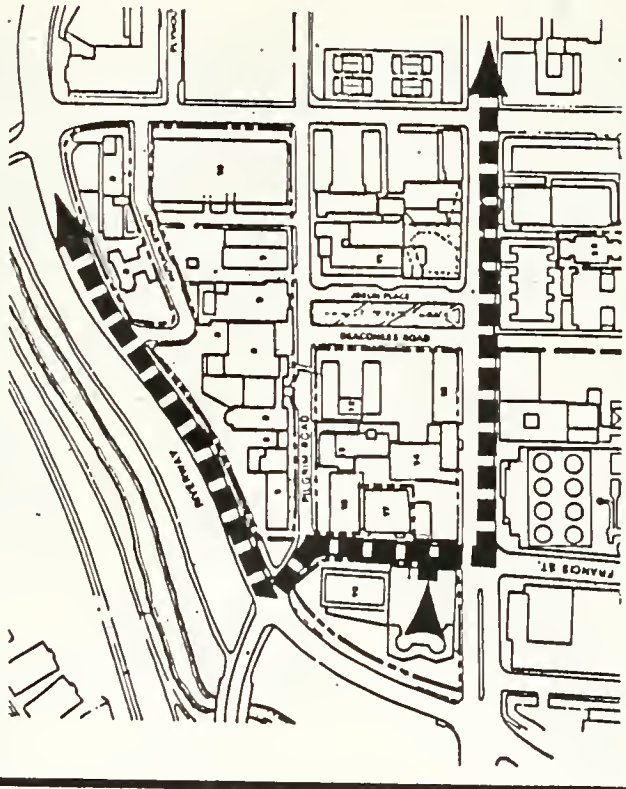




FROM

TRAFFIC PATTERN

TO/FROM 110 FRANCIS ST. - NORTH

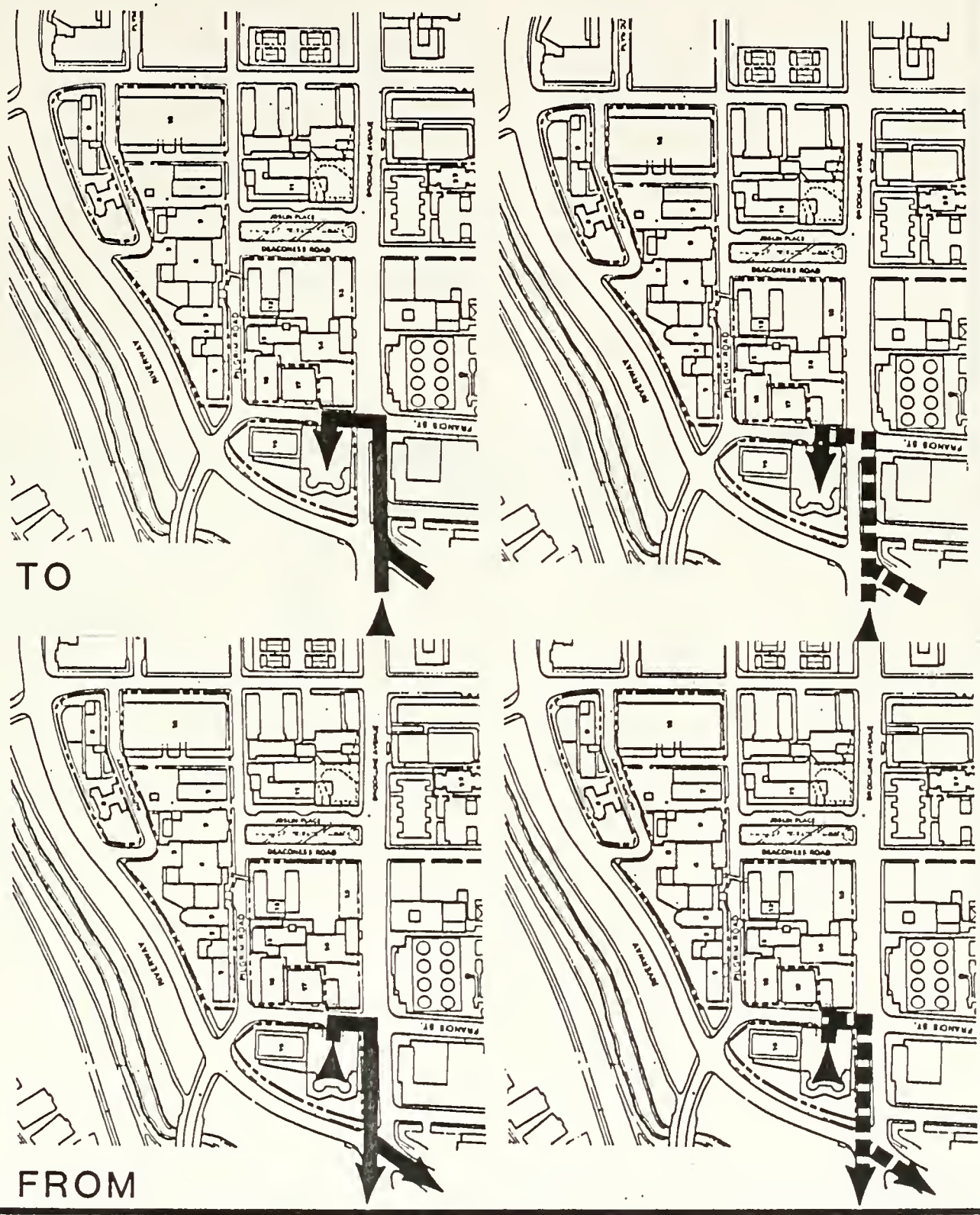
ABEND ASSOCIATES

EXH. 13

am-36 pm-30

BEFORE

AFTER



TRAFFIC PATTERN

TO/FROM 110 FRANCIS ST. - SOUTH

ABEND ASSOCIATES

EXH. 14

DELAY AND LOS SUMMARY

	AM Peak Hour		PM Peak Hour	
Intersection	Existing	w/Pilgrim Rd. Closed	Existing	w/Pilgrim Rd. Closed
Brookline/Francis	24.67/C	21.74/C	80.04/F	82.82/F
Brookline/Deaconess	1.88/A	2.15/A	4.03/A	4.82/A
Brookline/Longwood	5.28/B	5.15/B	18.20/C	18.04/C

EFFECT AT INTERSECTIONS

ABEND ASSOCIATES

EXH. 15

Hospital Building Access and Loading

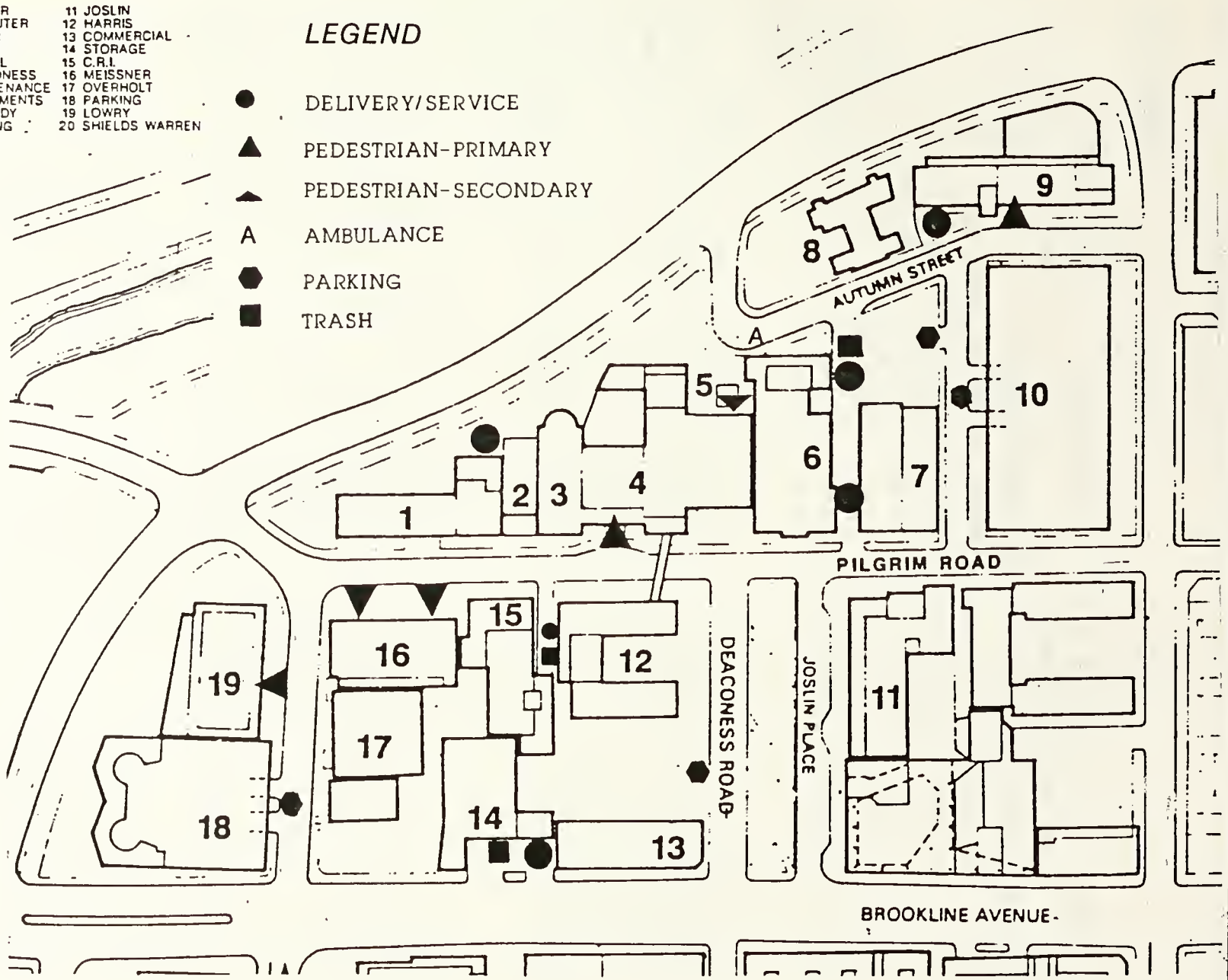
Exhibit 16 shows a plan of the campus showing the access points to all buildings. The access points are broken up into five categories, as follows:

1. Primary Pedestrian Access
2. Material Delivery
3. Parking Access
4. Ambulance Access
5. Rubbish Pick-Up

It is noteworthy that the primary access on Pilgrim Road between Longwood Avenue and the Riverway is the main pedestrian access on Pilgrim Road which will be relocated to Deaconess Road as part of the proposed new construction. Relocation of the main entrance is part of the overall master plan for the hospital and is consistent with the projected circulation in the area.

The proposed closure of Pilgrim Road between Deaconess Road and Francis Street will not affect the existing or future operations of the hospital. The new building will be served by the material center off of Brookline Avenue and the primary receiving area at the Laundry Building and will not add to the number of truck docks on the NEDH campus. No access points of any other property owner will be affected by the closure of Pilgrim Road. The closure is not expected to have any effect on any routes of approach or departure although there may be some slight dislocation regarding access to the Cancer Research Center.

HOSPITAL ACCESS POINTS



ABEND ASSOCIATES

EXH 16

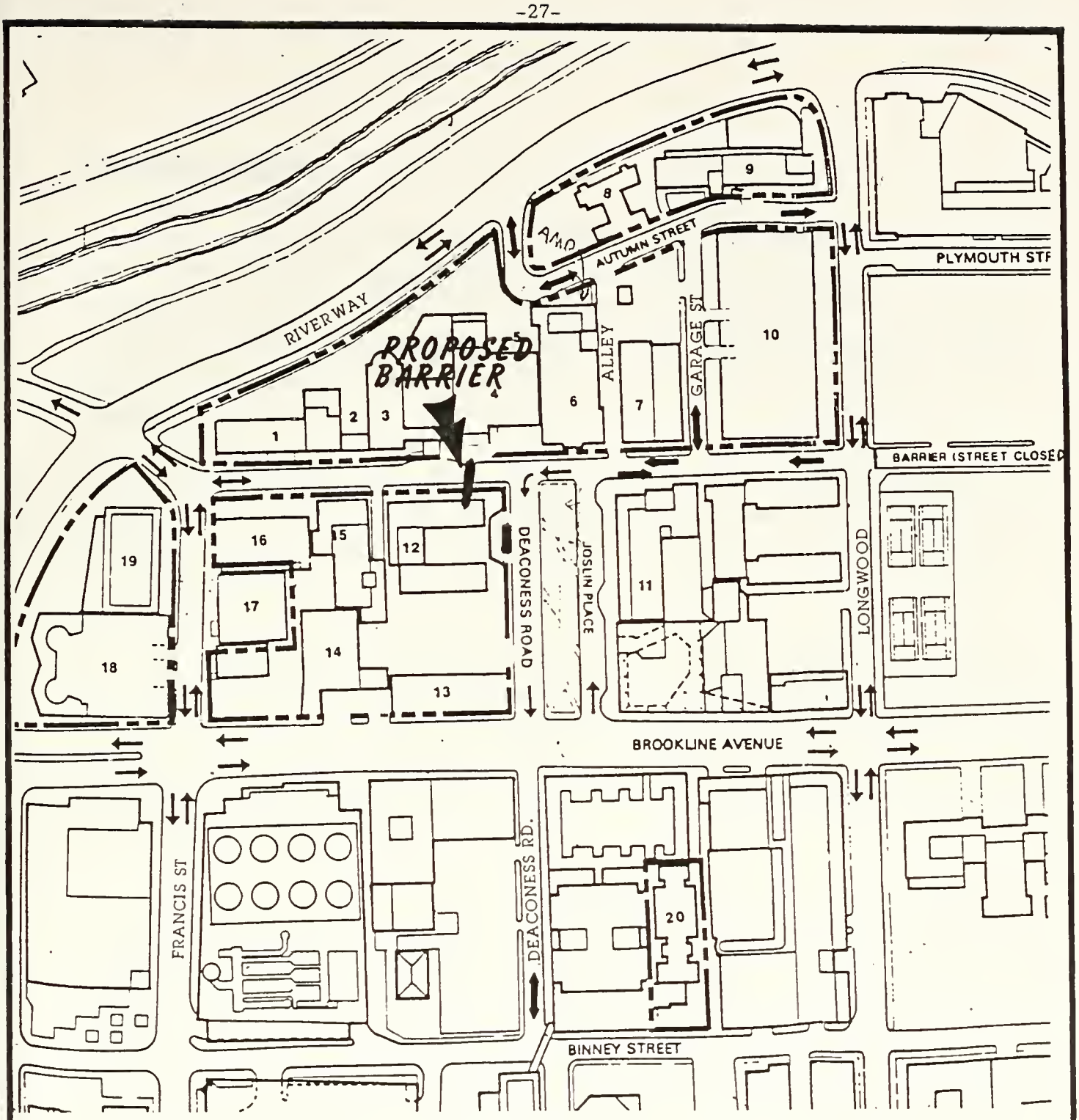
Fire Access

Exhibit 17 shows a diagrammatic representation of the streets that would be available for circulation in the area after the discontinuance of the short section of Pilgrim Road. The area is laced with both major and minor streets and privately owned driveways providing good public safety access. The NEDH campus is surrounded by three major streets and is broken into small areas by several smaller streets which serve the hospital and cut through the campus. Except for the portion occupied by the bridge link, Pilgrim Road will still be available for emergency vehicle access.

NEDH will make provisions in their connection structure across Pilgrim Road to permit emergency access through the structure so that fire-fighting personnel and hoses can move freely from one side to the other. The connections would have doors that would normally be closed but could be opened for emergencies. The discontinued portion of Pilgrim Road would be designed so that emergency vehicles would continue to have direct access to all buildings.

As a further mitigating measure to maintain mid-block circulation capabilities, NEDH would be willing to modify the radius of the sharp curve on Autumn Street to make it more useful as an alternate route for use during emergencies when other streets may be blocked. As part of this routing, NEDH would also be willing to modify the corner radius at the intersection of Garage Road and Autumn Street to facilitate the flow of traffic to and from the Riverway. These improvements would be done at NEDH's expense.

A future possible improvement related to long-range hospital plans which call for the removal of the NEDH building would be the construction of a connection from Pilgrim Road running directly to the Riverway. However, no commitments can be made at this time that this connection would be built. However, the proposed improvements to the Garage Road/Autumn Street routing offers a good substitute.



LOCAL CIRCULATION NETWORK

ABEND ASSOCIATES

EXH 17

Construction Access

In coordination with its construction management team, the Hospital will provide the City with an appropriate construction management plan when the details of construction have been completed. Because most of the construction involves frontage along interior streets, namely Deaconess Road and Pilgrim Road, construction phase impacts on Brookline Avenue are expected to be small.

If the closure of Pilgrim Road is made prior to construction, it is expected that the discontinued portion of Pilgrim Road will serve as an important staging area for construction, particularly since the focus of construction is at that location.

On Deaconess Road, the current cross-section provides for parallel parking on both sides of the street and one wide lane for through traffic. It appears at this point that the removal of parking along the curb where construction will occur will be necessary. However, the travel lane and the parallel parking along Joslin Park will be unaffected by construction activities and could remain.

On Brookline Avenue, the current construction plan does not require the displacement of parking or any travel lanes. Since the project calls for the widening of Brookline Avenue by one lane between Deaconess Road and Francis Street, this widening should take place during the early phases of construction and then used for construction staging. Theoretically, this would allow the existing curb parking to remain. Practically, however, it is likely that the curb parking along the Brookline Avenue block face between Deaconess Road and Francis Street would probably be discontinued for parts of the construction project. These details will be refined in the Construction Access Plan.

No provisions are being made for construction worker parking in the area. There are no spaces within the NEDH area for the provision of such parking, nor is there suitable parking in the area. The MASCO area has seen

major construction projects over the past several years, and garage operators have been particularly alert to prevent construction parking that would displace demands of hospital patients and visitors. It is expected that NEDH and other institutions in the area would continue this vigilance.

In sum, the construction process will not result in any reduction in travel lanes on any streets. It will probably result in the removal of curb parking on one side of Deaconess Road and, possibly, on one block face of Brookline Avenue. A total of about 15 spaces are involved. Construction truck access will be along major arterial streets already used for construction access to other developments in the medical area. The Riverway is not accessible to trucks and will not be used for access. Any local streets used for construction access are those within the NEDH area and will not affect abutters. Joslin Park will be unaffected by construction and will continue to function, as will the remaining open portion of Pilgrim Road and all other streets in the NEDH campus.

Mitigation and Improvement of Traffic Flow

NEDH has considered and proposes several modifications which would mitigate any adverse effect resulting from the closing of Pilgrim Road to through traffic and would substantially improve local traffic conditions on Brookline Avenue:

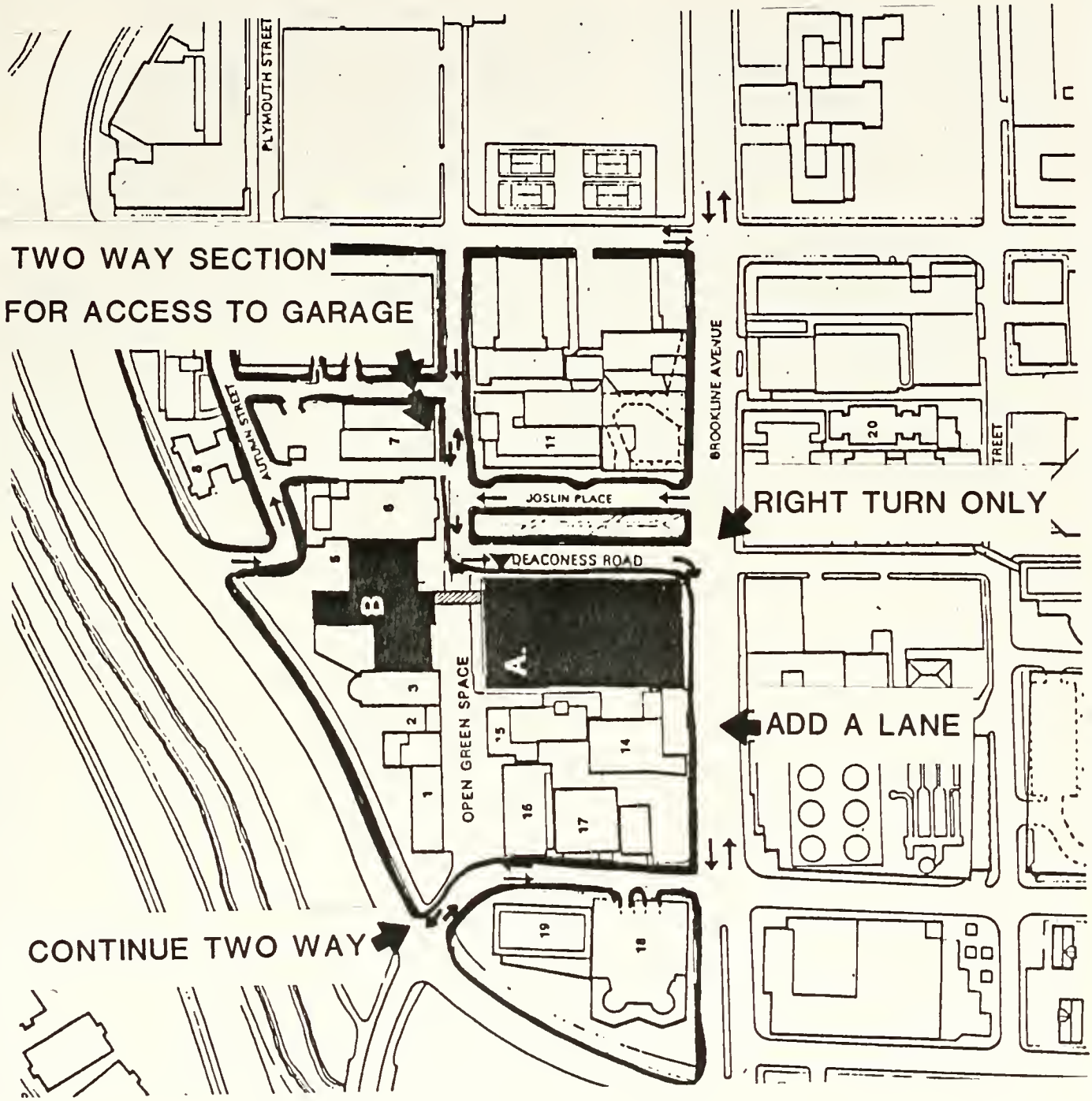
1. Provide the City of Boston with a widening of Brookline Avenue between Deaconess Road and Francis Street to accommodate a third lane in the southbound direction.
2. Prohibit left-turns onto Brookline Avenue from Deaconess Road. This would force cars leaving the NEDH campus to proceed south to the Riverway or to alternate routes, decreasing northerly traffic on Brookline Avenue and relieving the congestion caused by left-turns onto Brookline Avenue.
3. Make Pilgrim Road two-way from Joslin Place to the garage access road. This will permit south-oriented traffic to enter the garage without going through the Brookline/Longwood intersection.
4. Relocate NEDH's main supply center on Brookline Avenue between Deaconess Road and Francis Street to an off-site location. Only full consolidated loads would be transferred to the hospital during off-peak periods.

NEDH does not plan on any additional parking on its campus. The proposed construction will result in a net reduction in employee commuter spaces which will result in a decrease in peak hour volumes. The proposed changes are as follows:

1. Eliminate 20 employee parking spaces in the Pilgrim Road garage and use these spaces for patient parking for the ambulatory care unit. This will reduce peak hour volumes since patient visits are scheduled during the middle part of the day.
2. A 50 car doctors' parking lot will be eliminated by the construction of the new building. These spaces will be replaced either by convert-

ing existing employee commuter spaces or by partial replacement at other locations. This will result in some reduction in peak hour trips.

Exhibit 11 shows the location of the proposed traffic mitigation. The net result of these actions is expected to result in a reduction in peak hour trips generated by the hospital. The increase in roadway capacity by the added southbound lane on Brookline Avenue should have a noticeable effect on local traffic conditions. The prohibition of left-turns from Deaconess onto Brookline should enhance the overall upgrading.



PROPOSED TRAFFIC MITIGATION

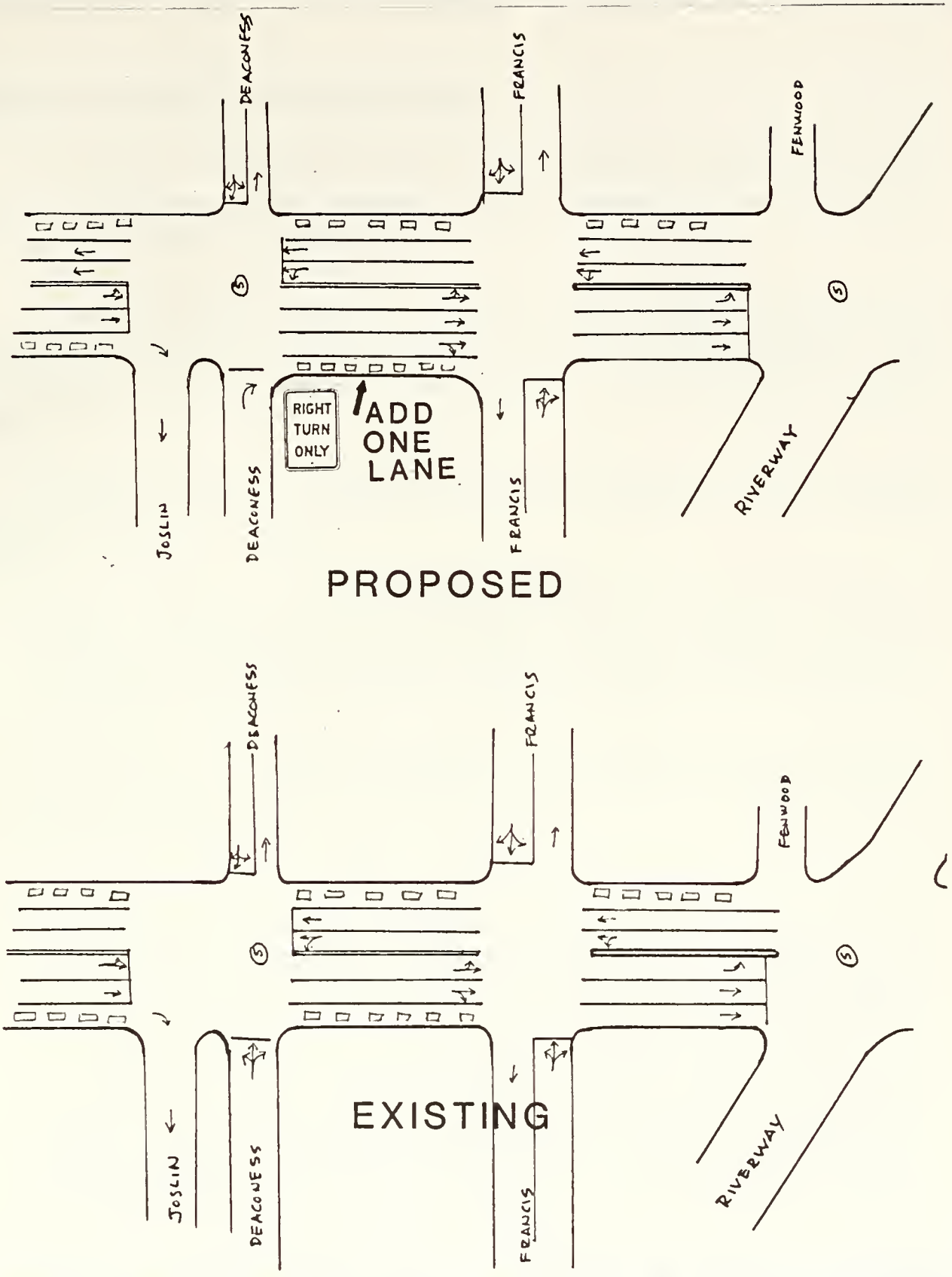
ABEND ASSOCIATES

EXH. 18

Added Lane on Brookline Avenue

To mitigate the impacts of the project, and to improve the overall traffic congestion in the Longwood Medical Area, NEDH has proposed the widening of Brookline Avenue to add an extra lane southbound between Deaconess Road and Francis Street. This will tie in with the three lane southbound cross-section south of Francis Street as shown in Exhibit 19.

This will provide extra storage for the signal at Brookline/Riverway as well as an extra lane through the Brookline/Francis intersection. This will improve the situation here by allowing storage for the left-turn into Francis Street. Regardless of how the extra lane is used, it is an improvement that has definite and substantial value. It is a direct replacement for the loss of the one southbound lane on Pilgrim Road and will compensate for the proposed closing of Pilgrim Road.



PROPOSED BROOKLINE AVE. WIDENING

ABEND ASSOCIATES

EXH. 19

Traffic Management and Reduction Program

A number of actions have been taken by NEDH to enhance the use of public transportation and carpools, and to reduce the total volume of automobiles approaching the hospital.

It is particularly noteworthy that the current hospital expansion will result in a reduction in parking spaces used by commuting employees which the hospital does not intend to substitute for elsewhere in the immediate area.

Among the traffic management and reduction measures that the hospital engages in are the following:

1. The establishment of two off-site parking lots that are served by a MASCO or an NEDH shuttle bus. These lots are in locations that are specifically intended to prevent additional vehicles from approaching the MASCO area.

2. The hospital provides a convenient on-site location for purchasing MBTA passes, and actively encourages their use by in-house mailings and correspondence.

3. The hospital subsidizes MBTA passes for its employees.

4. The hospital operates a self-park valet system at the 110 Francis Street garage to provide peak period parking, generally between the hours of 11:00 am to 2:30 pm. This is the time when parking demand is greatest for patients. This type of parking is specifically for patients and does not adversely affect the commuter peak hours. It is noteworthy that a growing proportion of the hospital's parking supply is being devoted to patient parking. Although the hospital's parking supply has remained constant, the employee parking supply has been reduced.

NEDH is an active MASCO participant and supports all MASCO programs aimed at reducing local traffic. In addition, the hospital has its own program for off-site parking and is investigating additional off-site parking

locations. The hospital has no plans for expanding on-site parking and has gradually reduced the number of commuter spaces by allocating spaces for midday non-commuter purposes.

APPENDIX

Vanasse Hangen
60 Burlington Parkway
Boston [illegible] Massachusetts 02135
617 [illegible]

Consulting Engineers
& Planners

May 16, 1986

Ref: 1518

Mr. Robert Kroin
Boston Redevelopment Authority
One City Hall Square
Boston, MA 02201

Re: New England Deaconess Hospital

In advance of our meeting on Wednesday, May 21, 1986 at 9:30 AM to discuss the New England Deaconess Hospital's patient care facility, I am pleased to transmit a copy of a memorandum prepared by Vanasse/Hangen on traffic issues.

We look forward to the opportunity to review this project with you.

Very truly yours,

VANASSE/HANGEN

David A. Bohn

David A. Bohn, P.E.
Associate

DAB/mef
Enclosure

cc: Larry Koff, BRA
Phil Caruso, BTD
Gary Lahey, Payette Assoc.
Hugh Sycamore, NEDH

1518/586/trl

VH

Memorandum

To:	Mr. Gary Lahey, Principal Payette Associates 40 Isabella Street Boston, MA	Date:	May 16, 1986
		Ref:	1518
From:	Vanasse/Hangen 60 Birmingham Parkway Boston, MA 02135	Re:	New England Deaconess Hospital - Proposed Patient Care Facility Replacement

Introduction

The New England Deaconess Hospital (NEDH) has proposed the construction of a new building which would be located adjacent to existing hospital facilities and require the closure of a portion of Pilgrim Road. NEDH is located in Boston's Longwood Medical Area (LMA) in a triangular area bounded by Riverway, Longwood Avenue and Brookline Avenue. Pilgrim Road functions as a relatively minor local street in the network and it primarily serves to provide direct access to NEDH and its main patient entrance which is located just west of Deaconess Road. In order to quantify the impacts of the proposed closure, a series of detailed traffic observations were conducted including mechanical recorder counts, manual turning movement counts and a brief origin - destination survey. The following sections of this report describe the technical approach and detail the findings of the analysis.

Study Area

The boundaries defined for this study of the proposed closure of Pilgrim Road are Riverway on the north and west, Brookline Avenue on the south and Longwood Avenue on the east. Within this study area are several additional roadways including:

Pilgrim Road
Deaconess Road
Joslin Place
Autumn Street
Francis Street
NEDH Garage Access Road
Alley between Deaconess and Maintenance Buildings

Brookline Avenue, Riverway and Longwood Avenue all function as major arterial roadways carrying daily volumes in excess of 9,000 vehicles per day (vpd).

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Consulting Engineers & Planners
60 Birmingham Parkway, Boston, MA 02135
617/783-7000

Date: May 16, 1986
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The other roadways in the study area all function as collector roadways by providing local access to adjacent land uses and to a lesser degree, they carry only a limited amount of regional and through traffic.

Several of the smaller roadways in the study area are posted as one way streets. These roadway segments are:

Deaconess Road - one way eastbound between Pilgrim Road and Brookline Ave.
Joslin Place - one way westbound
Autumn Street - one way northbound
Pilgrim Road - one way westbound (between Longwood Avenue and Francis Street only)

Pilgrim Road itself is approximately 25 feet wide on the one one way westbound section near Deaconess Road. Drivers arriving at the existing main entrance in the Fair Building use a small drop off loop which has been constructed on the north side of Pilgrim Road, just west of Deaconess Road.

Two major NEDH parking facilities are located in the study area: (1) the 10 Francis Garage - 310 spaces, and (2) the NEDH garage adjacent to Longwood Avenue and Pilgrim Road - 751 spaces. Several other small parking lots are also located in the study area, in addition a limited amount of on-street parking on Brookline Avenue, Deaconess Road, Joslin Place, Autumn Street and Pilgrim Road near the NEDH garage.

On going Development in the LMA

There are several on-going building projects currently under construction in the LMA including the following:

- Brigham & Womens ASB II Building & 240 space garage - Francis Street
- Dana-Farber addition - Brookline Avenue
- Children's Hospital, Blackfan Project - Bed replacement, Longwood Avenue
- Harvard University Teaching Facility - Longwood Avenue
- Galleria expansion at Longwood/Brookline Avenues

In addition to these projects, MASCO has initiated discussions for a development on the site of the Temple Israel parking lot. At this point however, the project is only in its conceptual planning stages.

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Date: May 16, 1986
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Data Collection

A detailed traffic counting program was conducted in the section of the LMA adjacent to the Deaconess Hospital. Included were both manual peak period turning movement observations conducted by NEDH Staff as well as mechanical recorder counts. Additionally, a one hour origin-destination survey was conducted to aid in the identification of Pilgrim Road travel patterns. The purpose of this effort was to identify the major travel patterns in the study area and to quantify the usage level of Pilgrim Road.

Because there is a considerable amount of traffic volume data available from previous Vanasse/Hangen studies, the new data collection effort focused on roadways which have not been recently counted. Counts were taken by NEDH Staff and adjusted manually by Vanasse/Hangen Staff. The following table summarizes the locations which were counted manually as part of this study:

Table 1
Traffic Data Collection Program

Manual Turning Movement Locations (AM and PM peak periods)

1. Riverway/Francis Street
2. Pilgrim Road/Francis Street
3. Pilgrim Road/Deaconess Road/Joslin Place
4. Brookline Avenue/Deaconess Road/Joslin Place
5. Pilgrim Road/NEDH Garage Access Road
6. Pilgrim Road/Longwood Avenue

In addition, a mechanical counting program yielded several peak period counts that were used to check those taken manually.

This new data, was combined with previously available traffic data to produce Figures 1 and 2. The figures define the existing AM and PM peak period traffic flow patterns in the study area. Table 2 summarizes the estimated daily traffic volume information for this study, along with a summary of peak period traffic volumes.

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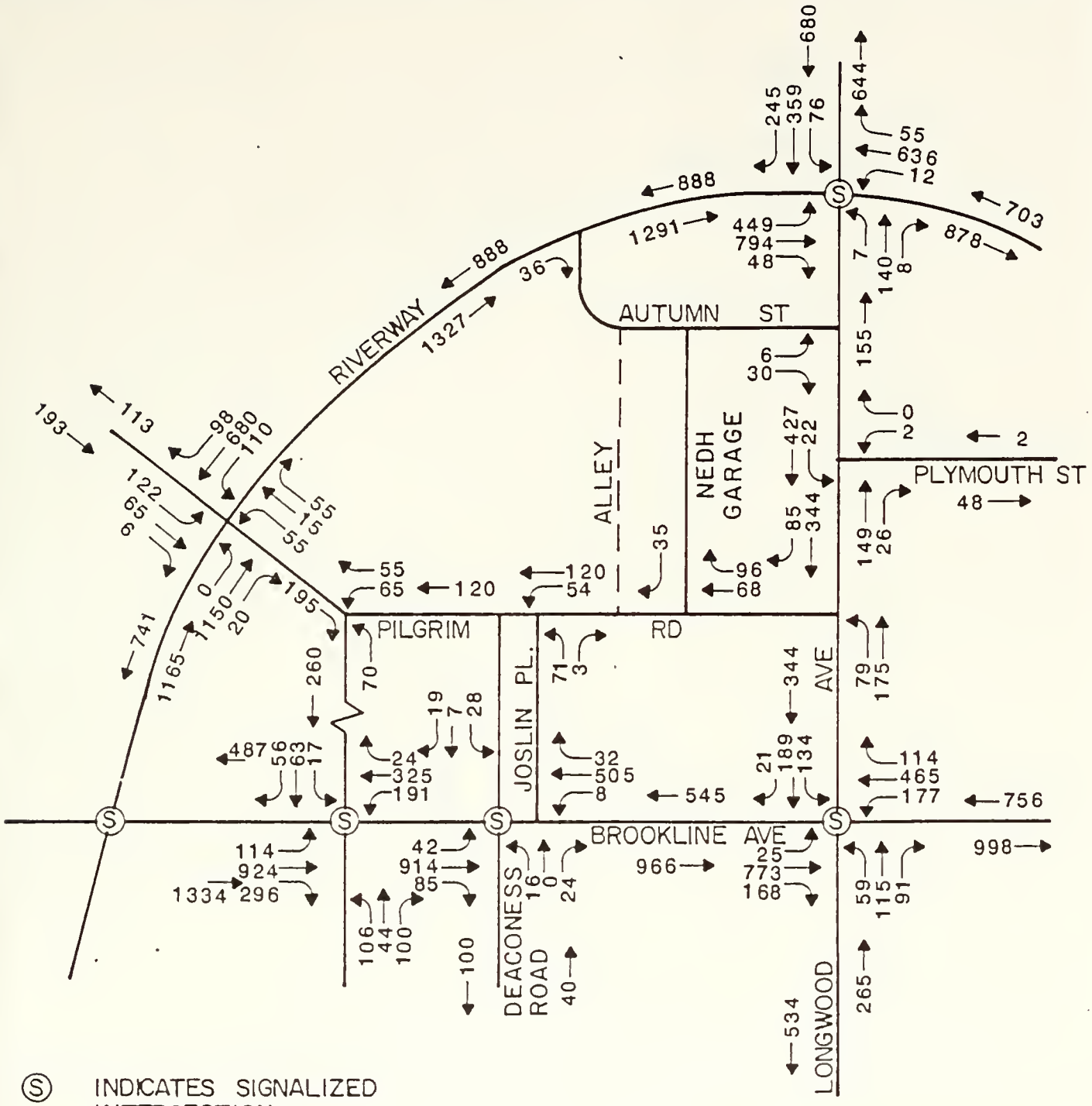

(S) INDICATES SIGNALIZED INTERSECTION

NOTE: Based primarily on volumes measured 4/85 and 5/86

Existing A.M. Peak Period Volumes

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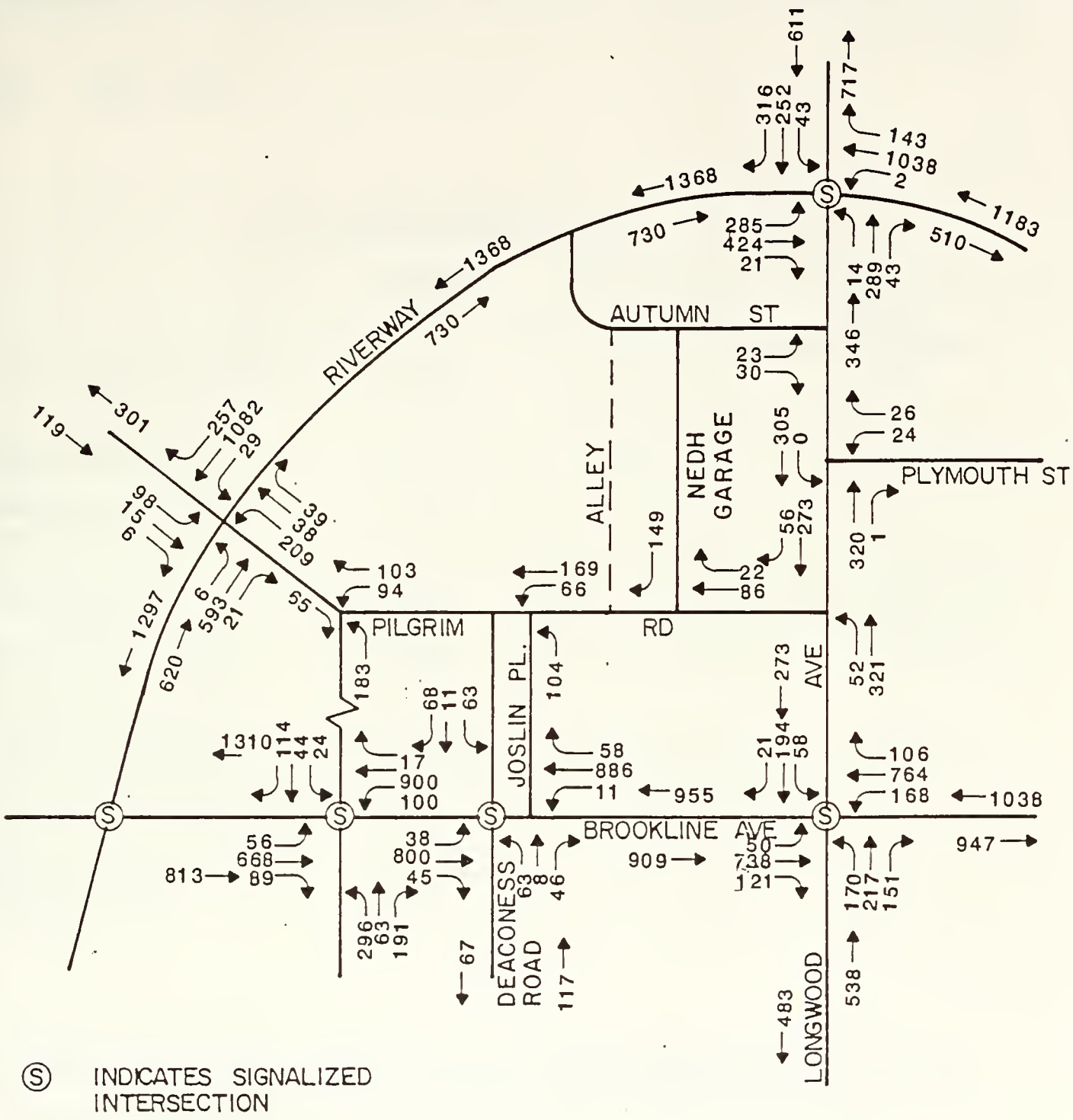
60 Burmingham Parkway, Boston, MA 02135

Not to Scale

Fig. 1



Ⓢ INDICATES SIGNALIZED INTERSECTION

NOTE: Based primarily on volumes measured 4/85 and 5/86

Existing P.M. Peak Period Volumes

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Consulting Engineers & Planners
60 Burmingham Parkway, Boston, MA 02135

Not to Scale

Fig. 2

Date: May 16, 1986
Ref: 1518

Table 2
Daily Traffic Volume summary

Location	ESTIMATED ADT*	AM Peak Hour** Volume	PM Peak Hour** Volume
Pilgrim Road just east of Joslin Place	2,700	177	235
Pilgrim Road east of Francis Street	2,100	120	197
Deaconess Road north of Brookline Avenue	1,300	54	142
Joslin Place north of Brookline Avenue	1,200	74	104
Francis Street between Pilgrim Rd & Riverway	3,700	320	351
Longwood Avenue between Binney & Blackfan Sts.	14,588***	999	1,025
Longwood Avenue between Pilgrim Rd & Brookline Ave.	9,000	598	646
Brookline Avenue north of Longwood Avenue	29,293***	1,754	1,985

* Average Daily Traffic - Estimate based on peak period turn volumes presented in Figures 1 and 2, except where *** indicates a different source.

** AM and PM Peak Volumes are reported from Figures 1 and 2. 7:30-8:30 AM and 4:00-5:00 PM represent the peak volume periods indicated in Figures 1 and 2.

*** September, 1983 data

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Date: May 16, 1986
Ref: 1518

A review of the data reveals several interesting findings. Probably of greatest interest are the volumes measured on Pilgrim Road itself, on the section proposed to be closed between Deaconess Road and Francis Street. On a daily basis, it is estimated that 2,100 vehicles per day (vpd) travel on this section. Peak hour volumes were found to be 120 and 197 vehicles during the AM and PM peak periods respectively. Obviously, these volumes are quite low in comparison to Brookline Avenue, the nearest adjacent parallel roadway which carries 1700 - 2000 vehicles per hour (vph) during the same periods.

Based on the volume measurements, it appears that during the morning peak, Pilgrim Road functions almost solely to provide direct access to adjacent institutions and parking with the NEDH garage being the prime generator of trips along the roadway. Through traffic traveling over the section to be closed is quite low and is estimated to be in the range of 25 - 50 vehicles.

The situation is quite similar during the afternoon peak, although the volumes are higher. It appears the the NEDH garage is again the major generator of Pilgrim Road traffic. During the afternoon, it appears that some drivers utilize Pilgrim Road as a southbound bypass of Brookline Avenue. Based on the counts presented in Figure 2, it is estimated that 25 - 50 vehicles on the section of Pilgrim Road to be closed are through vehicles.

Usage of Francis Street to enter or cross the Riverway traffic stream was found to be relatively high particularly during the PM peak when 286 vehicles were observed. The bulk of the vehicles using this roadway segment come from Francis Street; 103 were observed approaching from Pilgrim Road.

Origin - Destination Survey

In order to gather additional information on travel patterns along Pilgrim Road, an origin-destination survey was conducted during a one hour period in the afternoon peak when many drivers are exiting the area.

A total of 36 drivers were interviewed on Pilgrim Road at a point just west of Deaconess Road, near the drop off loop in front of the Deaconess Hospital's main entrance. Based on an afternoon peak period volume of approximately 195 vehicles, this represents an 18 percent sample of drivers using this roadway.

The results were quite interesting -- of the 36 interviews conducted, 31 drivers (or 86%) indicated that they had at least one trip end at the Deaconess or the Joslin Diabetes Center. Table 2 summarizes the findings:

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Date: May 16, 1986
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Table 2
Origin-Destination Survey Results

Origins		Destinations	
Deaconess Garage	10	Deaconess Garage	6
Joslin Diabetes Center	3	Deaconess Hospital	10
Deaconess Hospital	2	Boston Locations	5
Boston Locations	11	Other Communities	15
Other Communities	10	Total	36
Total	36		

These findings, combined with the results of the traffic count observations clearly indicate the predominance of local Deaconess oriented traffic on Pilgrim Road. Of the surveys conducted, only 14 percent of the drivers could be classified as through vehicles - that is those who don't have a trip end at an institution abutting Pilgrim Road. These findings support the estimates of through traffic developed in the previous section of this memorandum.

Analysis of the Impact of Closing a Portion of Pilgrim Road

There is precedent for closing Pilgrim Road, in fact a section north of Longwood Avenue was closed several years ago and has been absorbed by the Winsor School. Similarly, Children's Hospital recently modified the street pattern around its Blackfan Building by closing Blackfan Street and Children's Way to through traffic.

Based on the results of the traffic counts, it does not appear that the proposed closure would significantly affect traffic flow in the LMA. Based on current usage levels during the busiest period of the day, fewer than 200 vehicles would be rerouted. The potential closing is enhanced by two key points:

1. Most of the drivers on Pilgrim Road are attracted to the area by NEDH and are not through drivers, and

2. Pilgrim Road is currently one way and the proposed closure will have a lesser impact than if the street carried two way traffic.

A significant portion of the traffic now using Pilgrim Road turns left onto Francis Street in order to reach the 10 Francis Garage or Brookline Avenue. These drivers would now be forced to exit onto Brookline Avenue via Deaconess Road, resulting in a small increase in delay at this signal. NEDH traffic now exiting Pilgrim Road to Francis Street would also be reduced, creating safer operations at the Francis Street/Riverway intersection. Under the current road pattern all drivers would be diverted to Deaconess Road to travel on Brookline Avenue to reach their ultimate destinations.

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Date: May 16, 1986
Ref: 1518

Conclusion

Based on the results of this study, several conclusions can be drawn:

-- Pilgrim Road currently carries a relatively low volume of traffic, most of which is primarily affiliated with NEDH.

-- Peak hour volumes on the section of Pilgrim Road proposed to be closed range from 120 vehicles per hour (vph) during the AM peak hour to 197 vph during the PM peak.

-- On a daily basis, an estimated 2,100 vehicles per day (vpd) would be affected by the proposed closing of Pilgrim Road.

-- The bulk of Pilgrim Road traffic would divert to Deaconess Road and would then proceed either east or west on Brookline Avenue. It is not expected that these diversions will significantly increase the amount of traffic at any of the area's signalized intersections.

-- One of the major generators of traffic on Pilgrim Road is the NEDH garage and only 25 - 50 vehicles during either peak period can be considered through vehicles.

-- The proposed closure could improve operations at the unsignalized intersection of Joslin Place and Brookline Avenue since the number of turns, particularly left turns into Joslin Place would be reduced to only those drivers dropping off at the relocated Deaconess main entrance.

-- Closing Pilgrim Road would reduce the amount of traffic that would exit from Francis Street onto the Riverway. This location is currently unsignalized and based on the Riverway volumes, exiting from this point is extremely difficult, particularly for vehicles turning left or traveling straight out of Francis Street.

-- The closure would eliminate pedestrian/vehicle conflicts on Pilgrim Road itself.

Based on the preceding findings, it does not appear that the closing of Pilgrim Road proposed by Payette Associates for the New England Deaconess Hospital will significantly affect traffic flow in the immediate study area proximate to the site.

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Date: May 16, 1986
Ref: 1518

This report has not evaluated the potential transportation impacts of the proposed building project itself, nor has it developed mitigation measures or an access plan for the project.

cc: Hugh Sycamore, NEDH
Larry Koff, BRA
Bob Kroin, BRA
Phil Caruso, BTD

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APPENDIX
-- Origin Destination Survey Results

NEW ENGLAND DEACONESS HOSPITAL
PILGRIM ROAD
ORIGIN/DESTINATION SUMMARY

Deaconess Garage	10	Deaconess Garage	6
Joslin Diabetes Center	3	Deaconess Hospital	10
Hyde Park	2	Dedham	3
Cambridge	1	Medway	1
Deaconess School of Nursing	1	Melrose	1
Rego Bros. Pharmacy	1	Brockton	1
West Roxbury	1	Longwood Pharmacy	1
Roxbury	1	Walpole	1
Windsor School	1	Wellesley	1
Waltham	1	West Roxbury	1
Children's Hospital	1	Marshfield	1
Deaconess Hospital	1	West Bridgewater	1
E. Greenwich, CN	1	Randolph	1
Salisbury	1	Framingham	1
Westwood	1	Canton	1
Brookline	1	Marshfield	1
Dedham	1	Longwood, Riverway	1
Natick	1	Newton	1
MDC Police Base	1	Roslindale	1
Jamaica Plain	1	Park Square	1
Somerville	1		
Cape Cod	1		
Brookline Avenue	1		
Roslindale	1		
Total Motorists Interviewed	36		36

Was the trip a part of visit to N.E. Deaconess?	Yes	No	Total
	31	5	36

Survey conducted May 6, 1986 between 4:00 - 5:00 PM on the one way westbound section of Pilgrim Road at a location just west of Deaconess Road.

NEW ENGLAND DEACONESS HOSPITAL
PILGRIM ROAD
ORIGIN/DESTINATION SUMMARY

Deaconess Garage	10	Deaconess Garage	6
Joslin Diabetes Center	3	Deaconess Hospital	10
Hyde Park	2	Dedham	3
Cambridge	1	Medway	1
Deaconess School of Nursing	1	Melrose	1
Rego Bros. Pharmacy	1	Brockton	1
West Roxbury	1	Longwood Pharmacy	1
Roxbury	1	Walpole	1
Windsor School	1	Wellesley	1
Waltham	1	West Roxbury	1
Children's Hospital	1	Marshfield	1
Deaconess Hospital	1	West Bridgewater	1
E. Greenwich, CN	1	Randolph	1
Salisbury	1	Framingham	1
Westwood	1	Canton	1
Brookline	1	Marshfield	1
Dedham	1	Longwood, Riverway	1
Natick	1	Newton	1
MDC Police Base	1	Roslindale	1
Jamaica Plain	1	Park Square	1
Somerville	1		
Cape Cod	1		
Brookline Avenue	1		
Roslindale	1		
Total Motorists Interviewed	36		36

Was the trip a part of visit to N.E. Deaconess?	Yes	No	Total
	31	5	36

Survey conducted May 6, 1986 between 4:00 - 5:00 PM on the one way westbound section of Pilgrim Road at a location just west of Deaconess Road.

CAPACITY CALCULATIONS

NOTE: EXISTING + PROJECT = PILGRIM RD. CLOSED

NCH PROGRAM VERSION DATE 2-6-1987
85 HCM - CHAPTER 9: SIGNALIZED - OPERATIONAL ANALYSIS
ACONESS HOSPITAL
OOKLINE/FRANCIS/AM/EXISTING
te:08-03-1987 time:20:48:38
ST DATA SET NAMES LOADED OR SAVED
LUME=BRFRAME GEOMETRICS=BRKFR SIGNAL=BRKFR
CATED IN CBD:Y
LUME & GEOMETRICS

	VOLUMES			# OF LANES			LANE WIDTH			CROSS
R	LT	TH	RT	LT	TH	RT	LT	TH	RT	WALK
	17	63	56	0	1	0	0.0	12.0	0.0	0
	106	44	100	0	1	0	0.0	12.0	0.0	0
	114	924	296	0	2	1	0.0	12.0	12.0	0
	191	325	24	0	2	0	0.0	12.0	0.0	0

AFFIC & ROADWAY CONDITIONS

			ADJ PARK			PEDESTRIANS			ARR
R	GRADE	%HV	Y/N	MOVES	BUSES	PHF	CROSS	BUT MIN TIME	TYPE
	0.0%	0.0%	N	0	0	.900	0	7.0	3
	0.0%	0.0%	N	0	0	.900	0	7.0	3
	0.0%	0.0%	N	0	0	.900	0	7.0	3
	0.0%	0.0%	N	0	0	.900	0	7.0	3

ASINGS

EASTBOUND				WESTBOUND				NORTHBOUND				SOUTHBOUND				GREEN	Y+R	PRE/ACT
l	t	r	p	l	t	r	p	l	t	r	p	l	t	r	p			
*	*	*		*	*	*										27.4	3	A
								*	*	*		*	*	*		78.6	3	A

CLE= 112.0

LUME ADJUSTMENT WORKSHEET
RT 1 (MOVEMENT ADJUSTMENTS)

R	LTV	THV	RTV	PHF	LTFR	THFR	RTFR
	17	63	56	.900	19	70	62
	106	44	100	.900	118	49	111
	114	924	296	.900	127	1027	329
	191	325	24	.900	212	361	27

RT 2 (LANE GROUP ADJUSTMENTS)

R	LN GROUP	FLOW	N	LU	v	Plt	Prt
	LT-TH-RT	151	1	1.00	151	0.13	0.41
	LT-TH-RT	278	1	1.00	278	0.42	0.40
	LT-TH	1153	2	1.05	1211	0.11	0.00
	RT	329	1	1.00	329	0.00	1.00
	LT-TH-RT	600	2	1.05	630	0.35	0.04

RT 3 (OPPOSING VOLUME ADJUSTMENTS)

FT TURN	OPPOSING APPROACH								
ING OPPOSED	VOLUMES			% OPPOSING LEFT TURN			# LANES			OPPOSING
	LT	TH	RT	LT	TH	RT	LT	TH	RT	VOLUME
STBOUND	118	49	111	100	100	100	0	1	0	160
STBOUND	19	70	62	100	100	100	0	1	0	132
RTHBOUND	212	361	27	100	100	100	0	2	0	600
UTHBOUND	127	1027	329	100	100	0	0	2	1	1153

QUATION FLOW ADJUSTMENT WORKSHEET

LT-TH-RT	1800	1	1.000	1.000	1.000	1.000	1.000	0.900	0.844	0.934	1278
LT-TH-RT	1800	1	1.000	1.000	1.000	1.000	1.000	0.900	0.846	0.818	1120
LT-TH	1800	2	1.000	1.000	1.000	1.000	1.000	0.900	1.000	0.525	1702
RT	1800	1	1.000	1.000	1.000	1.000	1.000	0.900	0.850	1.000	1377
LT-TH-RT	1800	2	1.000	1.000	1.000	1.000	1.000	0.900	0.993	0.577	1858

PPLEMENTAL WORKSHEET FOR LEFT-TURN ADJUSTMENT FACTOR FLT
PUT VARIABLES

R	C	G	N	Va	Vm	Vlt	Plt	No	Vo	Plto
	112	27	1	151	132	19	0.13	1	160	0.42
	112	27	1	278	160	118	0.42	1	132	0.13
	112	79	2	1153	1399	127	0.11	2	600	0.35
	112	79	2	600	600	212	0.35	2	1153	0.11

LCULATIONS

R	Sop	Yo	Gu	Fs	Pl	Gq	Pt	Gf	El	Fm	Flt
	1528	0.105	17.505	0.775	0.125	9.895	0.875	6.769	1.452	0.934	0.934
	1704	0.078	20.282	0.792	0.424	7.118	0.576	2.336	1.420	0.818	0.818
	6	1.000	0.000	0.500	1.000	78.600	0.000	0.000	2.250	0.051	0.525
	3165	0.364	59.456	0.154	1.000	19.145	0.000	0.000	7.297	0.155	0.577

PACITY ANALYSIS WORKSHEET

R	LN GROUP	v	s	v/s	g/C	c	v/c	CRITICAL
	LT-TH-RT	151	1278	0.12	0.24	313	0.48	
	LT-TH-RT	278	1120	0.25	0.24	274	1.01	*
	LT-TH	1211	1702	0.71	0.70	1195	1.01	*
	RT	329	1377	0.24	0.70	966	0.34	
	LT-TH-RT	630	1858	0.34	0.70	1304	0.48	

LE=112.0 LOST= 6.0 SUM V/S CRIT= 0.96 TOTAL V/C= 1.01

EL OF SERVICE WORKSHEET

LN GROUP	v/c	g/C	C	d1	c	d2	PF	Delay	LOS	Avg Q	95% Q
LT-TH-RT	0.48	0.24	112.0	27.54	313	0.95	0.85	24.22	C	3.6	
LT-TH-RT	1.01	0.24	112.0	32.29	274	45.65	0.85	66.24	F	8.4	
LT-TH	1.01	0.70	112.0	13.11	1195	23.26	0.85	30.92	D	15.3	
RT	0.34	0.70	112.0	4.97	966	0.09	0.85	4.30	A	3.1	
LT-TH-RT	0.48	0.70	112.0	5.73	1304	0.23	0.85	5.06	B	5.6	

Delay	LOS
24.22	C
66.24	F
25.23	D
5.06	B

ERSECTION DELAY = 24.67 INTERSECTION LOS=C

CYCLE LENGTH WITHIN THE BOUNDS OF 40 TO 120 SECONDS
CH MINIMIZES CRITICAL MOVEMENT DELAY IS 112.0 SECONDS

V/C RATIO CAN'T BE .95 FOR THE GIVEN CONDITIONS
EXISTING TIMING IS OPTIMAL

```
NCH PROGRAM VERSION DATE 2-6-1987
35 HCM - CHAPTER 9: SIGNALIZED - OPERATIONAL ANALYSIS
ACONESS HOSPITAL
OOKLINE/FRANCIS/AM/EXISTING+PROJECT
:e:08-03-1987                    time:20:53:15
ST DATA SET NAMES LOADED OR SAVED
LUME=BRFRAME    GEOMETRICS=BRKFR        SIGNAL=BRKFR
CATED IN CBD:Y
LUME & GEOMETRICS
      VOLUMES          # OF LANES      LANE WIDTH       CROSS
R   LT    TH    RT     LT TH RT       LT    TH    RT     WALK
    17    63    32      0  1  0      0.0  12.0   0.0      0
   106    44   100      0  1  0      0.0  12.0   0.0      0
   114   924   296      0  2  1      0.0  12.0  12.0      0
   191   349    24      0  2  0      0.0  12.0   0.0      0

AFFIC & ROADWAY CONDITIONS
                ADJ PARK                    PEDESTRIANS          ARR
R GRADE %HV     Y/N MOVES BUSES   PHF  CROSS BUT MIN TIME TYPE
  0.0% 0.0%     N      0     0   .900     0          7.0    3
  0.0% 0.0%     N      0     0   .900     0          7.0    3
  0.0% 0.0%     N      0     0   .900     0          7.0    3
  0.0% 0.0%     N      0     0   .900     0          7.0    3

SINGS
  EASTBOUND     WESTBOUND     NORTHBOUND     SOUTHBOUND   GREEN  Y+R PRE/ACT
  l  t  r  p    l  t  r  p    l  t  r  p    l  t  r  p
  *  *  *       *  *  *                                   24.7    3    A
                             *  *  *       *  *  *       75.3    3    A

LE= 106.0

LUME ADJUSTMENT WORKSHEET
T 1 (MOVEMENT ADJUSTMENTS)
   LTV   THV   RTV    PHF   LTFR  THFR  RTFR
    17    63    32   .900     19    70    36
   106    44   100   .900    118    49   111
   114   924   296   .900    127  1027   329
   191   349    24   .900    212   388    27

T 2 (LANE GROUP ADJUSTMENTS)
 LN GROUP   FLOW N    LU     v   Plt   Prt
 LT-TH-RT    124 1 1.00   124 0.15 0.29
 LT-TH-RT    278 1 1.00   278 0.42 0.40
 LT-TH      1153 2 1.05  1211 0.11 0.00
 RT          329 1 1.00   329 0.00 1.00
 LT-TH-RT    627 2 1.05   658 0.34 0.04

T 3 (OPPOSING VOLUME ADJUSTMENTS)
T TURN                  OPPOSING APPROACH
NG OPPOSED        VOLUMES       % OPPOSING LEFT TURN     # LANES      OPPOSING
                  LT   TH   RT      LT   TH   RT       LT  TH  RT     VOLUME
TBOUND           118   49  111     100  100  100       0   1   0       160
TBOUND            19   70   36     100  100  100       0   1   0       106
THBOUND          212  388   27     100  100  100       0   2   1       [illegible]
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TURATION FLOW ADJUSTMENT WORKSHEET

R	LN GROUP	IDEAL	N	Fwid	Fhv	Fgr	Fpark	Fbus	Farea	Frt	Flt	s
	LT-TH-RT	1800	1	1.000	1.000	1.000	1.000	1.000	0.900	0.861	0.917	1279
	LT-TH-RT	1800	1	1.000	1.000	1.000	1.000	1.000	0.900	0.846	0.870	1192
	LT-TH	1800	2	1.000	1.000	1.000	1.000	1.000	0.900	1.000	0.527	1706
	RT	1800	1	1.000	1.000	1.000	1.000	1.000	0.900	0.850	1.000	1377
	LT-TH-RT	1800	2	1.000	1.000	1.000	1.000	1.000	0.900	0.994	0.579	1864

PPLEMENTAL WORKSHEET FOR LEFT-TURN ADJUSTMENT FACTOR FLT

PUT VARIABLES

R	C	G	N	Va	Vm	Vlt	Plt	No	Vo	Plto
	106	25	1	124	106	19	0.15	1	160	0.42
	106	25	1	278	160	118	0.42	1	106	0.15
	106	75	2	1153	1399	127	0.11	2	627	0.34
	106	75	2	627	627	212	0.34	2	1153	0.11

LCULATIONS

R	Sop	Yo	Gu	Fs	Pl	Gq	Pt	Gf	El	Fm	Flt
	1544	0.104	15.317	0.775	0.152	9.396	0.848	6.019	1.452	0.917	0.917
	1685	0.063	19.278	0.809	0.424	5.434	0.576	2.110	1.391	0.870	0.870
	6	1.000	0.000	0.483	1.000	75.288	0.000	0.000	2.328	0.053	0.527
	3142	0.367	57.475	0.154	1.000	17.812	0.000	0.000	7.297	0.158	0.579

PACITY ANALYSIS WORKSHEET

R	LN GROUP	v	s	v/s	g/C	c	v/c	CRITICAL
	LT-TH-RT	124	1279	0.10	0.23	298	0.42	
	LT-TH-RT	278	1192	0.23	0.23	278	1.00	*
	LT-TH	1211	1706	0.71	0.71	1212	1.00	*
	RT	329	1377	0.24	0.71	978	0.34	
	LT-TH-RT	658	1864	0.35	0.71	1324	0.50	

CLE=106.0 LOST= 6.0 SUM V/S CRIT= 0.94 TOTAL V/C= 1.00

VEL OF SERVICE WORKSHEET

R	LN GROUP	v/c	g/C	C	d1	c	d2	PF	Delay	LOS	Avg Q	95% Q
	LT-TH-RT	0.42	0.23	106.0	26.24	298	0.57	0.85	22.79	C	2.8	
	LT-TH-RT	1.00	0.23	106.0	30.88	278	41.34	0.85	61.39	F	7.9	
	LT-TH	1.00	0.71	106.0	11.65	1212	19.74	0.85	26.68	D	13.5	
	RT	0.34	0.71	106.0	4.44	978	0.08	0.85	3.84	A	2.8	
	LT-TH-RT	0.50	0.71	106.0	5.23	1324	0.25	0.85	4.66	A	5.3	

Delay	LOS
22.79	C
61.39	F
21.81	C
4.66	A

ERSECTION DELAY = 21.74 INTERSECTION LOS=C

CYCLE LENGTH WITHIN THE BOUNDS OF 40 TO 0 SECONDS
CH MINIMIZES CRITICAL MOVEMENT DELAY IS 106.0 SECONDS

A V/C RATIO OF .95 THE CYCLE SHOULD BE 792.8 SECONDS
EXISTING TIMING IS OPTIMAL

ICH PROGRAM VERSION DATE 2-6-1987
S HCM - CHAPTER 9: SIGNALIZED - OPERATIONAL ANALYSIS
CONESS HOSPITAL
OKLINE/FRANCIS/PM/EXISTING
e:08-03-1987 time:21:00:19
T DATA SET NAMES LOADED OR SAVED
UME=BRFRPME GEOMETRICS=BRKFR SIGNAL=BRKFR
ATED IN CBD:Y
UME & GEOMETRICS

VOLUMES			# OF LANES			LANE WIDTH			CROSS
LT	TH	RT	LT	TH	RT	LT	TH	RT	WALK
24	44	114	0	1	0	0.0	12.0	0.0	0
296	63	191	0	1	0	0.0	12.0	0.0	0
56	668	89	0	2	1	0.0	12.0	12.0	0
100	900	17	0	2	0	0.0	12.0	0.0	0

FFIC & ROADWAY CONDITIONS

		ADJ PARK			PEDESTRIANS			ARR
GRADE	%HV	Y/N	MOVES	BUSES	PHF	CROSS	BUT MIN TIME	TYPE
0.0%	0.0%	N	0	0	.900	0	7.0	3
0.0%	0.0%	N	0	0	.900	0	7.0	3
0.0%	0.0%	N	0	0	.900	0	7.0	3
0.0%	0.0%	N	0	0	.900	0	7.0	3

SINGS

EASTBOUND				WESTBOUND				NORTHBOUND				SOUTHBOUND				GREEN	Y+R	PRE/ACT
l	t	r	p	l	t	r	p	l	t	r	p	l	t	r	p			
*	*	*		*	*	*												
								*	*	*		*	*	*		57.7	3	A
																56.3	3	A

LE= 120.0

UME ADJUSTMENT WORKSHEET
T 1 (MOVEMENT ADJUSTMENTS)

LTV	THV	RTV	PHF	LTFR	THFR	RTFR
24	44	114	.900	27	49	127
296	63	191	.900	329	70	212
56	668	89	.900	62	742	99
100	900	17	.900	111	1000	19

T 2 (LANE GROUP ADJUSTMENTS)

LN GROUP	FLOW	N	LU	v	Plt	Prt
LT-TH-RT	202	1	1.00	202	0.13	0.63
LT-TH-RT	611	1	1.00	611	0.54	0.35
LT-TH	804	2	1.05	845	0.08	0.00
RT	99	1	1.00	99	0.00	1.00
LT-TH-RT	1130	2	1.05	1187	0.10	0.02

T 3 (OPPOSING VOLUME ADJUSTMENTS)

T TURN	OPPOSING APPROACH								
NG OPPOSED	VOLUMES			% OPPOSING LEFT TURN			# LANES			OPPOSING
	LT	TH	RT	LT	TH	RT	LT	TH	RT	VOLUME
TBOUND	329	70	212	100	100	100	0	1	0	282
TBOUND	27	49	127	100	100	100	0	1	0	176
THBOUND	111	1000	19	100	100	100	0	2	0	1130
TUBOUND	62	742	99	100	100		0			

TURATION FLOW ADJUSTMENT WORKSHEET

R	LN GROUP	IDEAL	N	Fwid	Fhv	Fgr	Fpark	Fbus	Farea	Frt	Flt	s
	LT-TH-RT	1800	1	1.000	1.000	1.000	1.000	1.000	0.900	0.815	0.871	1150
	LT-TH-RT	1800	1	1.000	1.000	1.000	1.000	1.000	0.900	0.853	0.778	1075
	LT-TH	1800	2	1.000	1.000	1.000	1.000	1.000	0.900	1.000	0.564	1828
	RT	1800	1	1.000	1.000	1.000	1.000	1.000	0.900	0.850	1.000	1377
	LT-TH-RT	1800	2	1.000	1.000	1.000	1.000	1.000	0.900	0.997	0.662	2139

PPLEMENTAL WORKSHEET FOR LEFT-TURN ADJUSTMENT FACTOR FLT

PUT VARIABLES

R	C	G	N	Va	Vm	Vlt	Plt	No	Vo	Plto
	120	58	1	202	176	27	0.13	1	282	0.54
	120	58	1	611	282	329	0.54	1	176	0.13
	120	56	2	804	903	62	0.08	2	1130	0.10
	120	56	2	1130	1130	111	0.10	2	804	0.08

LCULATIONS

R	Sop	Yo	Gu	Fs	Fl	Gq	Pt	Gf	El	Fm	Flt
	1437	0.196	42.476	0.699	0.132	15.230	0.868	8.681	1.610	0.871	0.871
	1666	0.105	50.368	0.765	0.538	7.338	0.462	1.615	1.470	0.778	0.778
	2862	0.395	14.721	0.169	0.701	41.573	0.299	0.854	6.667	0.128	0.564
	2503	0.321	26.122	0.372	0.488	30.172	0.512	2.102	3.022	0.324	0.662

PACITY ANALYSIS WORKSHEET

R	LN GROUP	v	s	v/s	g/C	c	v/c	CRITICAL
	LT-TH-RT	202	1150	0.18	0.48	553	0.37	
	LT-TH-RT	611	1075	0.57	0.48	517	1.18	*
	LT-TH	845	1828	0.46	0.47	857	0.99	
	RT	99	1377	0.07	0.47	646	0.15	
	LT-TH-RT	1187	2139	0.55	0.47	1004	1.18	*

CLE=120.0 LOST= 6.0 SUM V/S CRIT= 1.12 TOTAL V/C= 1.18

VEL OF SERVICE WORKSHEET

R	LN GROUP	v/c	g/C	C	d1	c	d2	PF	Delay	LOS	Avg Q	95% Q
	LT-TH-RT	0.37	0.48	120.0	14.91	553	0.19	0.85	12.84	B	3.5	
	LT-TH-RT	1.18	0.48	120.0	28.47	517	107.81	0.85	115.84	F	25.0	
	LT-TH	0.99	0.47	120.0	23.89	857	20.41	0.85	37.66	D	15.5	
	RT	0.15	0.47	120.0	13.85	646	0.01	0.85	11.78	B	1.7	
	LT-TH-RT	1.18	0.47	120.0	28.86	1004	99.27	0.85	108.90	F	44.2	

R	Delay	LOS
	12.84	B
	115.84	F
	34.95	D
	108.90	F

TERSECTION DELAY = 80.04 INTERSECTION LOS=F

E CYCLE LENGTH WITHIN THE BOUNDS OF 40 TO 120 SECONDS
ICH MINIMIZES CRITICAL MOVEMENT DELAY IS 120.0 SECONDS

E V/C RATIO CAN'T BE .95 FOR THE GIVEN CONDITIONS
E EXISTING TIMING IS OPTIMAL

```
INCH PROGRAM VERSION DATE 2-6-1987
985 HCM - CHAPTER 9: SIGNALIZED - OPERATIONAL ANALYSIS
EACONESS HOSPITAL
ROOKLINE/FRANCIS/PM/EXISTING+PROJECT
ate:08-03-1987                          time:21:06:34
AST DATA SET NAMES LOADED OR SAVED
OLUME=BRFRPMEP   GEOMETRICS=BRKFR        SIGNAL=BRKFR
OCATED IN CBD:Y
OLUME & GEOMETRICS
          VOLUMES          # OF LANES        LANE WIDTH        CROSS
R   LT    TH    RT      LT TH RT       LT    TH    RT        WALK
      24    24    39      0  1  0      0.0  12.0   0.0         0
     296    63   191      0  1  0      0.0  12.0   0.0         0
      56   668    89      0  2  1      0.0  12.0  12.0         0
     100   995    17      0  2  0      0.0  12.0   0.0         0

AFFIC & ROADWAY CONDITIONS
                ADJ PARK                          PEDESTRIANS              ARR
R GRADE  %HV    Y/N MOVES BUSES    PHF  CROSS BUT MIN TIME  TYPE
  0.0%   0.0%    N     0     0    .900     0          7.0     3
  0.0%   0.0%    N     0     0    .900     0          7.0     3
  0.0%   0.0%    N     0     0    .900     0          7.0     3
  0.0%   0.0%    N     0     0    .900     0          7.0     3

ASINGS
   EASTBOUND     WESTBOUND     NORTHBOUND     SOUTHBOUND    GREEN  Y+R  PRE/ACT
   l  t  r  p    l  t  r  p    l  t  r  p    l  t  r  p
   *  *  *       *  *  *
                                *  *  *       *  *  *       51.1   3     A
                                                           62.9   3     A
CLE= 120.0

LUME ADJUSTMENT WORKSHEET
RT 1 (MOVEMENT ADJUSTMENTS)
R   LTV   THV   RTV    PHF   LTFR  THFR  RTFR
     24    24    39   .900     27    27    43
    296    63   191   .900    329    70   212
     56   668    89   .900     62   742    99
    100   995    17   .900    111  1106    19

T 2 (LANE GROUP ADJUSTMENTS)
  LN GROUP   FLOW N    LU     v    Plt   Prt
  LT-TH-RT     97 1  1.00    97  0.28  0.45
  LT-TH-RT    611 1  1.00   611  0.54  0.35
  LT-TH       804 2  1.05   845  0.08  0.00
  RT           99 1  1.00    99  0.00  1.00
  LT-TH-RT   1236 2  1.05  1297  0.09  0.02

T 3 (OPPOSING VOLUME ADJUSTMENTS)
T TURN                    OPPOSING APPROACH
NG OPPOSED          VOLUMES          % OPPOSING LEFT TURN      # LANES      OPPOSING
                    LT   TH   RT      LT   TH   RT          LT  TH  RT     VOLUME
TBOUND             329   70  212     100  100  100          0   1   0       282
TBOUND              27   27   43     100  100  100          0   1   0        70
THBOUND            111 1106   19     100  100  100          0   2   0      1236
THBOUND             62  742   99     100  100    0
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URATION FLOW ADJUSTMENT WORKSHEET

R	LN GROUP	IDEAL	N	Fwid	Fhv	Fgr	Fpark	Fbus	Farea	Frt	Flt	s
3	LT-TH-RT	1800	1	1.000	1.000	1.000	1.000	1.000	0.900	0.839	0.736	1001
3	LT-TH-RT	1800	1	1.000	1.000	1.000	1.000	1.000	0.900	0.853	0.871	1203
3	LT-TH	1800	2	1.000	1.000	1.000	1.000	1.000	0.900	1.000	0.551	1785
3	RT	1800	1	1.000	1.000	1.000	1.000	1.000	0.900	0.850	1.000	1377
3	LT-TH-RT	1800	2	1.000	1.000	1.000	1.000	1.000	0.900	0.998	0.642	2075

PPLEMENTAL WORKSHEET FOR LEFT-TURN ADJUSTMENT FACTOR FLT

PUT VARIABLES

R	C	G	N	Va	Vm	Vlt	Plt	No	Vo	Plto
3	120	51	1	97	70	27	0.28	1	282	0.54
3	120	51	1	611	282	329	0.54	1	70	0.28
3	120	63	2	804	903	62	0.08	2	1236	0.09
3	120	63	2	1236	1236	111	0.09	2	804	0.08

LCULATIONS

R	Sop	Yo	Gu	Fs	Pl	Gq	Pt	Gf	El	Fm	Flt
3	1512	0.187	35.288	0.699	0.276	15.808	0.724	4.841	1.610	0.736	0.736
	1541	0.045	47.816	0.831	0.538	3.280	0.462	1.233	1.353	0.871	0.871
	2913	0.424	20.840	0.103	0.810	42.064	0.190	0.469	10.946	0.102	0.551
	2035	0.395	25.570	0.372	0.493	37.334	0.507	2.053	3.022	0.284	0.642

PACITY ANALYSIS WORKSHEET

R	LN GROUP	v	s	v/s	g/C	c	v/c	CRITICAL
	LT-TH-RT	97	1001	0.10	0.43	426	0.23	
	LT-TH-RT	611	1203	0.51	0.43	512	1.19	*
	LT-TH	845	1785	0.47	0.52	935	0.90	
	RT	99	1377	0.07	0.52	722	0.14	
	LT-TH-RT	1297	2075	0.63	0.52	1088	1.19	*

CLE=120.0 LOST= 6.0 SUM V/S CRIT= 1.13 TOTAL V/C= 1.19

VEL OF SERVICE WORKSHEET

R	LN GROUP	v/c	g/C	C	d1	c	d2	PF	Delay	LOS	Avg Q	95% Q
	LT-TH-RT	0.23	0.43	120.0	16.64	426	0.05	0.85	14.19	B	1.9	
	LT-TH-RT	1.19	0.43	120.0	30.55	512	114.60	0.85	123.38	F	26.8	
	LT-TH	0.90	0.52	120.0	19.60	935	8.55	0.85	23.93	C	12.8	
	RT	0.14	0.52	120.0	11.12	722	0.01	0.85	9.46	B	1.6	
	LT-TH-RT	1.19	0.52	120.0	27.55	1088	105.12	0.85	112.77	F	48.5	

R	Delay	LOS
	14.19	B
	123.38	F
	22.41	C
	112.77	F

TERSECTION DELAY = 82.82 INTERSECTION LOS=F

E CYCLE LENGTH WITHIN THE BOUNDS OF 40 TO 120 SECONDS
ICH MINIMIZES CRITICAL MOVEMENT DELAY IS 120.0 SECONDS

E V/C RATIO CAN'T BE .95 FOR THE GIVEN CONDITIONS
E EXISTING TIMING IS OPTIMAL

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NCH PROGRAM VERSION DATE 2-6-1987
85 HCM - CHAPTER 9: SIGNALIZED - OPERATIONAL ANALYSIS
ACONESS HOSPITAL
OOKLINE/DEACONESS/AM/EXISTING
te:08-03-1987                    time:21:33:28
ST DATA SET NAMES LOADED OR SAVED
LUME=BRDJAME     GEOMETRICS=BRDJ          SIGNAL=BRKFR
CATED IN CBD:Y
LUME & GEOMETRICS
        VOLUMES          # OF LANES      LANE WIDTH       CROSS
R  LT    TH    RT       LT TH RT       LT    TH    RT     WALK
    28     7    19        0  2  0      0.0  12.0   0.0      0
    16     0    24        0  1  0      0.0  12.0   0.0      0
    42   914    85        0  2  0      0.0  12.0   0.0      0
     8   505    32        0  2  0      0.0  12.0   0.0      0

AFFIC & ROADWAY CONDITIONS
                ADJ PARK                    PEDESTRIANS          ARR
R GRADE %HV     Y/N MOVES BUSES  PHF  CROSS BUT MIN TIME TYPE
  0.0%  0.0%    N      0     0   .900     0          7.0    3
  0.0%  0.0%    N      0     0   .900     0          7.0    3
  0.0%  0.0%    N      0     0   .900     0          7.0    3
  0.0%  0.0%    N      0     0   .900     0          7.0    3

ASINGS
  EASTBOUND    WESTBOUND    NORTHBOUND   SOUTHBOUND GREEN  Y+R PRE/ACT
  l  t  r  p   l  t  r  p   l  t  r  p   l  t  r  p
  *  *  *      *  *  *                                  4.2   3    A
                             *  *  *      *  *  *      49.8   3    A

CLE=  60.0

LUME ADJUSTMENT WORKSHEET
RT 1 (MOVEMENT ADJUSTMENTS)
R  LTV   THV   RTV    PHF   LTFR THFR RTFR
    28     7    19   .900     31    8   21
    16     0    24   .900     18    0   27
    42   914    85   .900     47 1016   94
     8   505    32   .900      9  561   36

RT 2 (LANE GROUP ADJUSTMENTS)
R LN GROUP   FLOW N   LU     v   Plt  Prt
  LT-TH-RT     60 2 1.05    63 0.52 0.35
  LT-RT        44 1 1.00    44 0.40 0.60
  LT-TH-RT   1157 2 1.05  1215 0.04 0.08
  LT-TH-RT    606 2 1.05   636 0.01 0.06

RT 3 (OPPOSING VOLUME ADJUSTMENTS)
FT TURN                  OPPOSING APPROACH
ING OPPOSED       VOLUMES       % OPPOSING LEFT TURN     # LANES      OPPOSING
                  LT   TH   RT      LT    TH    RT      LT  TH  RT     VOLUME
STBOUND           18    0   27     100   100   100      0   1   0        27
STBOUND           31    8   21     100   100   100      0   2   0        60
RTHBOUND           9  561         100   100   100      0   2   0       606
UTHBOUND          47 101.          100   100   100      0   2   0      1157
```

R LN GROUP	IDEAL	N	Fwid	Fhv	Fgr	Fpark	Fbus	Farea	Frt	Flt	s
LT-TH-RT	1800	2	1.000	1.000	1.000	1.000	1.000	0.900	0.947	1.000	3069
LT-RT	1800	1	1.000	1.000	1.000	1.000	1.000	0.900	0.819	1.000	1327
LT-TH-RT	1800	2	1.000	1.000	1.000	1.000	1.000	0.900	0.988	0.960	3074
LT-TH-RT	1800	2	1.000	1.000	1.000	1.000	1.000	0.900	0.991	0.864	2773

PPLEMENTAL WORKSHEET FOR LEFT-TURN ADJUSTMENT FACTOR FLT
PUT VARIABLES

R C	G	N	Va	Vm	Vlt	Plt	No	Vo	Plto
60	4	2	60	60	31	0.52	1	27	0.40
60	4	1	44	27	18	0.40	2	60	0.52
60	50	2	1157	1157	47	0.04	2	606	0.01
60	50	2	606	606	9	0.01	2	1157	0.04

LCULATIONS

R Sop	Yo	Gu	Fs	Pl	Gq	Pt	Gf	El	Fm	Flt
1583	0.017	3.264	0.858	0.818	0.956	0.182	0.248	1.311	1.000	1.000
3101	0.019	3.119	0.838	1.000	1.101	0.000	0.000	1.343	1.000	1.000
3291	0.184	47.475	0.497	0.112	2.305	0.888	2.029	2.266	0.921	0.960
3425	0.338	44.569	0.152	0.079	5.211	0.921	4.496	7.397	0.727	0.864

PACITY ANALYSIS WORKSHEET

R LN GROUP	v	s	v/s	g/C	c	v/c	CRITICAL
LT-TH-RT	63	3069	0.02	0.07	216	0.29	
LT-RT	44	1327	0.03	0.07	93	0.48	*
LT-TH-RT	1215	3074	0.40	0.83	2550	0.48	*
LT-TH-RT	636	2773	0.23	0.83	2301	0.28	

CLE= 60.0 LOST= 6.0 SUM V/S CRIT= 0.43 TOTAL V/C= 0.48

VEL OF SERVICE WORKSHEET

R LN GROUP	v/c	g/C	C	d1	c	d2	PF	Delay	LOS	Avg Q	95% Q
LT-TH-RT	0.29	0.07	60.0	20.12	216	0.22	0.85	17.29	C	0.9	
LT-RT	0.48	0.07	60.0	20.39	93	2.86	0.85	19.76	C	0.7	
LT-TH-RT	0.48	0.83	60.0	1.09	2550	0.11	0.85	1.02	A	3.3	
LT-TH-RT	0.28	0.83	60.0	0.86	2301	0.02	0.85	0.74	A	1.7	

R Delay	LOS
17.29	C
19.76	C
1.02	A
0.74	A

TERSECTION DELAY = 1.88 INTERSECTION LOS=A

E CYCLE LENGTH WITHIN THE BOUNDS OF 60 TO 120 SECONDS
ICH MINIMIZES CRITICAL MOVEMENT DELAY IS 60.0 SECONDS

R A V/C RATIO OF .95 THE CYCLE SHOULD BE 10.9 SECONDS
E EXISTING TIMING IS OPTIMAL

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NCH PROGRAM VERSION DATE 2-6-1987
'85 HCM - CHAPTER 9: SIGNALIZED - OPERATIONAL ANALYSIS
EACONESS HOSPITAL
OOKLINE/DEACONESS/AM/EXISTING+PROJECT
te:08-03-1987                    time:21:36:48
ST DATA SET NAMES LOADED OR SAVED
LUME=BRDJAMEP   GEOMETRICS=BRDJ        SIGNAL=BRKFR
CATED IN CBD:Y
LUME & GEOMETRICS
        VOLUMES        # OF LANES      LANE WIDTH      CROSS
R  LT    TH    RT     LT TH RT       LT    TH    RT     WALK
    28     7    43      0  2  0      0.0  12.0   0.0      0
    16     0    24      0  1  0      0.0  12.0   0.0      0
    62   914    85      0  2  0      0.0  12.0   0.0      0
     8   517    32      0  2  0      0.0  12.0   0.0      0

AFFIC & ROADWAY CONDITIONS
                ADJ PARK                    PEDESTRIANS          ARR
R GRADE %HV     Y/N MOVES BUSES  PHF  CROSS BUT MIN TIME  TYPE
  0.0%  0.0%    N      0     0   .900     0          7.0     3
  0.0%  0.0%    N      0     0   .900     0          7.0     3
  0.0%  0.0%    N      0     0   .900     0          7.0     3
  0.0%  0.0%    N      0     0   .900     0          7.0     3

ASINGS
   EASTBOUND    WESTBOUND    NORTHBOUND   SOUTHBOUND GREEN  Y+R PRE/ACT
   l  t  r  p   l  t  r  p   l  t  r  p   l  t  r  p
   *  *  *      *  *  *                                4.0   3    A
                           *  *  *      *  *  *       50.0   3    A

CLE=  60.0

LUME ADJUSTMENT WORKSHEET
RT 1 (MOVEMENT ADJUSTMENTS)
R  LTV  THV  RTV   PHF  LTFR THFR RTFR
    28    7   43  .900    31    8   48
    16    0   24  .900    18    0   27
    62  914   85  .900    69 1016   94
     8  517   32  .900     9  574   36

RT 2 (LANE GROUP ADJUSTMENTS)
R LN GROUP  FLOW N   LU     v  Plt  Prt
  LT-TH-RT    87 2 1.05    91 0.36 0.55
  LT-RT       44 1 1.00    44 0.40 0.60
  LT-TH-RT  1179 2 1.05  1238 0.06 0.08
  LT-TH-RT   619 2 1.05   650 0.01 0.06

RT 3 (OPPOSING VOLUME ADJUSTMENTS)
FT TURN                  OPPOSING APPROACH
ING OPPOSED       VOLUMES       % OPPOSING LEFT TURN    # LANES     OPPOSING
                  LT   TH   RT      LT   TH   RT       LT  TH  RT    VOLUME
STBOUND           18    0   27     100  100  100       0   1   0      27
STBOUND           31    8   48     100  100  100       0   2   0      87
RTHBOUND           9  574   36     100  100  100       0   2   0     619
UTHBOUND          69 1016   94     100  100  100
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ATURATION FLOW ADJUSTMENT WORKSHEET

IR	LN GROUP	IDEAL	N	Fwid	Fhv	Fgr	Fpark	Fbus	Farea	Frt	Flt	s
B	LT-TH-RT	1800	2	1.000	1.000	1.000	1.000	1.000	0.900	0.917	1.000	2972
B	LT-RT	1800	1	1.000	1.000	1.000	1.000	1.000	0.900	0.819	1.000	1327
B	LT-TH-RT	1800	2	1.000	1.000	1.000	1.000	1.000	0.900	0.988	0.935	2994
B	LT-TH-RT	1800	2	1.000	1.000	1.000	1.000	1.000	0.900	0.991	0.850	2729

UPPLEMENTAL WORKSHEET FOR LEFT-TURN ADJUSTMENT FACTOR FLT
NPUT VARIABLES

IR	C	G	N	Va	Vm	Vlt	Plt	No	Vo	Plto
B	60	4	2	87	87	31	0.36	1	27	0.40
B	60	4	1	44	27	18	0.40	2	87	0.36
B	60	50	2	1179	1179	69	0.06	2	619	0.01
B	60	50	2	619	619	9	0.01	2	1179	0.06

ALCULATIONS

IR	Sop	Yo	Gu	Fs	Pl	Gq	Pt	Gf	El	Fm	Flt
B	1568	0.017	3.079	0.858	0.562	0.968	0.438	0.513	1.311	1.000	1.000
B	3239	0.027	2.509	0.821	1.000	1.538	0.000	0.000	1.371	1.000	1.000
B	3265	0.190	47.603	0.488	0.164	2.350	0.836	1.936	2.304	0.871	0.935
B	3345	0.352	44.484	0.138	0.082	5.468	0.918	4.672	8.141	0.699	0.850

APACITY ANALYSIS WORKSHEET

IR	LN GROUP	v	s	v/s	g/C	c	v/c	CRITICAL
B	LT-TH-RT	91	2972	0.03	0.07	200	0.45	
B	LT-RT	44	1327	0.03	0.07	90	0.50	*
B	LT-TH-RT	1238	2994	0.41	0.83	2493	0.50	*
B	LT-TH-RT	650	2729	0.24	0.83	2272	0.29	

YCLE= 60.0 LOST= 6.0 SUM V/S CRIT= 0.45 TOTAL V/C= 0.50

EVEL OF SERVICE WORKSHEET

IR	LN GROUP	v/c	g/C	C	d1	c	d2	PF	Delay	LOS	Avg Q	95% Q
B	LT-TH-RT	0.45	0.07	60.0	20.45	200	1.15	0.85	18.36	C	1.3	
B	LT-RT	0.50	0.07	60.0	20.51	90	3.48	0.85	20.40	C	0.7	
B	LT-TH-RT	0.50	0.83	60.0	1.09	2493	0.13	0.85	1.04	A	3.3	
B	LT-TH-RT	0.29	0.83	60.0	0.84	2272	0.02	0.85	0.73	A	1.7	

IR	Delay	LOS
B	18.36	C
B	20.40	C
B	1.04	A
B	0.73	A

NTERSECTION DELAY = 2.15 INTERSECTION LOS=A

HE CYCLE LENGTH WITHIN THE BOUNDS OF 60 TO 120 SECONDS
ICH MINIMIZES CRITICAL MOVEMENT DELAY IS 60.0 SECONDS

OR A V/C RATIO OF .95 THE CYCLE SHOULD BE 11.3 SECONDS
HE EXISTING TIMING IS OPTIMAL

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INCH PROGRAM VERSION DATE 2-6-1987
985 HCM - CHAPTER 9: SIGNALIZED - OPERATIONAL ANALYSIS
EACONESS HOSPITAL
ROOKLINE/DEACONESS/PM/EXISTING
ate:08-03-1987                    time:21:40:42
AST DATA SET NAMES LOADED OR SAVED
OLUME=BRDJPME    GEOMETRICS=BRDJ        SIGNAL=BRKFR
OCATED IN CBD:Y
OLUME & GEOMETRICS
        VOLUMES          # OF LANES      LANE WIDTH       CROSS
IR  LT    TH    RT      LT TH RT      LT    TH    RT      WALK
3   63    11    68       0  2  0     0.0  12.0   0.0       0
3   63     8    46       0  1  0     0.0  12.0   0.0       0
3   38   800    45       0  2  0     0.0  12.0   0.0       0
3   11   886    58       0  2  0     0.0  12.0   0.0       0

RAFFIC & ROADWAY CONDITIONS
                ADJ PARK                    PEDESTRIANS          ARR
IR GRADE %HV    Y/N MOVES BUSES  PHF  CROSS BUT MIN TIME  TYPE
3  0.0%  0.0%    N     0     0   .900     0          7.0     3
3  0.0%  0.0%    N     0     0   .900     0          7.0     3
3  0.0%  0.0%    N     0     0   .900     0          7.0     3
3  0.0%  0.0%    N     0     0   .900     0          7.0     3

HASINGS
   EASTBOUND    WESTBOUND    NORTHBOUND   SOUTHBOUND  GREEN  Y+R  PRE/ACT
   l  t  r  p   l  t  r  p   l  t  r  p   l  t  r  p
1  *  *  *      *  *  *
2                             *  *  *      *  *  *     10.4   3     A
                                                       43.6   3     A

YCLE=  60.0

OLUME ADJUSTMENT WORKSHEET
ART 1 (MOVEMENT ADJUSTMENTS)
IR  LTV  THV  RTV   PHF  LTFR THFR RTFR
3    63   11   68  .900    70   12   76
3    63    8   46  .900    70    9   51
3    38  800   45  .900    42  889   50
3    11  886   58  .900    12  984   64

ART 2 (LANE GROUP ADJUSTMENTS)
IR LN GROUP  FLOW N   LU     v   Plt  Prt
3  LT-TH-RT   158 2 1.05   166 0.44 0.48
3  LT-TH-RT   130 1 1.00   130 0.54 0.39
3  LT-TH-RT   981 2 1.05  1030 0.04 0.05
3  LT-TH-RT  1061 2 1.05  1114 0.01 0.06

ART 3 (OPPOSING VOLUME ADJUSTMENTS)
EFT TURN                  OPPOSING APPROACH
EING OPPOSED        VOLUI          % OPPOSING LEFT TURN     # LANES      OPPOSING
                  LT    TH           LT   TH   RT          TH  RT       VOLUME
ASTBOUND          70                100  100  100          1   0          60
ESTBOUND          70    1           100  100  100      0   2   0         158
ORTHBOUND         12   9[           100  100  100      0   2   0        1061
OUTHBOUND         43    [           100  100  1[
```

ATURATION FLOW ADJUSTMENT WORKSHEET

IR	LN GROUP	IDEAL	N	Fwid	Fhv	Fgr	Fpark	Fbus	Farea	Frt	Flt	s
B	LT-TH-RT	1800	2	1.000	1.000	1.000	1.000	1.000	0.900	0.928	1.000	3007
B	LT-TH-RT	1800	1	1.000	1.000	1.000	1.000	1.000	0.900	0.847	1.000	1372
B	LT-TH-RT	1800	2	1.000	1.000	1.000	1.000	1.000	0.900	0.992	0.804	2586
B	LT-TH-RT	1800	2	1.000	1.000	1.000	1.000	1.000	0.900	0.991	0.958	3076

UPPLEMENTAL WORKSHEET FOR LEFT-TURN ADJUSTMENT FACTOR FLT

NPUT VARIABLES

IR	C	G	N	Va	Vm	Vlt	Plt	No	Vo	Plto
B	60	10	2	158	158	70	0.44	1	60	0.54
B	60	10	1	130	60	70	0.54	2	158	0.44
B	60	44	2	981	981	42	0.04	2	1061	0.01
B	60	44	2	1061	1061	12	0.01	2	981	0.04

ALCULATIONS

IR	Sop	Yo	Gu	Fs	Pl	Gq	Ft	Gf	El	Fm	Flt
B	1450	0.041	8.233	0.838	0.848	2.143	0.152	0.312	1.343	1.000	1.000
B	3124	0.051	7.737	0.776	0.538	2.639	0.462	1.096	1.449	1.000	1.000
B	3468	0.306	36.405	0.212	0.197	7.219	0.803	4.462	5.311	0.609	0.804
B	3037	0.323	35.807	0.262	0.048	7.817	0.952	6.942	4.297	0.916	0.958

APACITY ANALYSIS WORKSHEET

IR	LN GROUP	v	s	v/s	g/C	c	v/c	CRITICAL
B	LT-TH-RT	166	3007	0.06	0.17	520	0.32	
B	LT-TH-RT	130	1372	0.09	0.17	237	0.55	*
B	LT-TH-RT	1030	2586	0.40	0.73	1880	0.55	*
B	LT-TH-RT	1114	3076	0.36	0.73	2237	0.50	

YCLE= 60.0 LOST= 6.0 SUM V/S CRIT= 0.49 TOTAL V/C= 0.55

EVEL OF SERVICE WORKSHEET

IR	LN GROUP	v/c	g/C	C	d1	c	d2	PF	Delay	LOS	Avg Q	95% Q
B	LT-TH-RT	0.32	0.17	60.0	16.51	520	0.13	0.85	14.14	B	2.2	
B	LT-TH-RT	0.55	0.17	60.0	17.23	237	2.03	0.85	16.37	C	1.8	
B	LT-TH-RT	0.55	0.73	60.0	2.82	1880	0.27	0.85	2.63	A	4.5	
B	LT-TH-RT	0.50	0.73	60.0	2.66	2237	0.15	0.85	2.39	A	4.8	

IR	Delay	LOS
B	14.14	B
B	16.37	C
B	2.63	A
B	2.39	A

NTERSECTION DELAY = 4.03 INTERSECTION LOS=A

HE CYCLE LENGTH WITHIN THE BOUNDS OF 60 TO 120 SECONDS
HICH MINIMIZES CRITICAL MOVEMENT DELAY IS 60.0 SECONDS

OR A V/C RATIO OF .95 THE CYCLE SHOULD BE 12.5 SECONDS
HE EXISTING TIMING IS OPTIMAL

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INCH PROGRAM VERSION DATE 2-6-1987
985 HCM - CHAPTER 9: SIGNALIZED - OPERATIONAL ANALYSIS
EACONESS HOSPITAL
ROOKLINE/DEACONESS/PM/EXISTING+PROJECT
ate:08-03-1987                    time:21:44:55
AST DATA SET NAMES LOADED OR SAVED
OLUME=BRDJPMEP   GEOMETRICS=BRDJ        SIGNAL=BRKFR
OCATED IN CBD:Y
OLUME & GEOMETRICS
        VOLUMES          # OF LANES      LANE WIDTH       CROSS
IR   LT    TH    RT     LT TH RT      LT    TH    RT      WALK
B    63    11   163      0  2  0     0.0  12.0   0.0       0
B    63     8    46      0  1  0     0.0  12.0   0.0       0
B    38   800    45      0  2  0     0.0  12.0   0.0       0
B    11   906    58      0  2  0     0.0  12.0   0.0       0

RAFFIC & ROADWAY CONDITIONS
                 ADJ PARK                    PEDESTRIANS          ARR
IR GRADE %HV     Y/N MOVES BUSES  PHF  CROSS BUT MIN TIME  TYPE
B  0.0%  0.0%    N      0     0  .900      0          7.0     3
B  0.0%  0.0%    N      0     0  .900      0          7.0     3
B  0.0%  0.0%    N      0     0  .900      0          7.0     3
B  0.0%  0.0%    N      0     0  .900      0          7.0     3

HASINGS
   EASTBOUND    WESTBOUND    NORTHBOUND    SOUTHBOUND   GREEN  Y+R PRE/ACT
   l  t  r  p   l  t  r  p   l  t  r  p   l  t  r  p
1  *  *  *      *  *  *
2                             *  *  *      *  *  *      11.4   3     A
                                                        42.6   3     A

YCLE=  60.0

OLUME ADJUSTMENT WORKSHEET
ART 1 (MOVEMENT ADJUSTMENTS)
IR  LTV   THV   RTV    PHF   LTFR THFR RTFR
B    63    11   163   .900    70   12  181
B    63     8    46   .900    70    9   51
B    38   800    45   .900    42  889   50
B    11   906    58   .900    12 1007   64

ART 2 (LANE GROUP ADJUSTMENTS)
IR LN GROUP   FLOW N   LU     v   Plt  Prt
B  LT-TH-RT    263 2 1.05   277 0.27 0.69
B  LT-TH-RT    130 1 1.00   130 0.54 0.39
B  LT-TH-RT    981 2 1.05  1030 0.04 0.05
B  LT-TH-RT   1083 2 1.05  1138 0.01 0.06

ART 3 (OPPOSING VOLUME ADJUSTMENTS)
EFT TURN                  OPPOSING APPROACH
ING OPPOSED          VOLUMES        % OPPOSING LEFT TURN     # LANES      OPPOSING
                     LT   TH   RT     LT   TH   RT        LT  TH  RT      VOLUME
ASTBOUND             70    9         100  100  100        0   1   0         60
ESTBOUND             70   12         100  100  100        0   2   0        263
ORTHBOUND            12  100         100  100  100        0   2   0       1083
 UTHBOUND            42   88         100  100  100        0   2   0
```

...RMATION FLOW ADJUSTMENT WORKSHEET

...R	LN GROUP	IDEAL	N	Fwid	Fhv	Fgr	Fpark	Fbus	Farea	Frt	Flt	s
...	LT-TH-RT	1800	2	1.000	1.000	1.000	1.000	1.000	0.900	0.897	1.000	2906
...	LT-TH-RT	1800	1	1.000	1.000	1.000	1.000	1.000	0.900	0.847	0.870	1194
...	LT-TH-RT	1800	2	1.000	1.000	1.000	1.000	1.000	0.900	0.992	0.791	2542
...	LT-TH-RT	1800	2	1.000	1.000	1.000	1.000	1.000	0.900	0.991	0.959	3080

...PPLEMENTAL WORKSHEET FOR LEFT-TURN ADJUSTMENT FACTOR FLT

...IPUT VARIABLES

...R	C	G	N	Va	Vm	Vlt	Flt	No	Vo	Plto
...	60	11	2	263	263	70	0.27	1	60	0.54
...	60	11	1	130	60	70	0.54	2	263	0.27
...	60	43	2	981	981	42	0.04	2	1083	0.01
...	60	43	2	1083	1083	12	0.01	2	981	0.04

...LCULATIONS

...R	Sop	Yo	Gu	Fs	Pl	Gq	Pt	Gf	El	Fm	Flt
...	1370	0.044	9.211	0.838	0.515	2.225	0.485	1.042	1.343	1.000	1.000
...	3299	0.080	7.223	0.710	0.538	4.213	0.462	1.378	1.584	0.870	0.870
...	3471	0.312	34.653	0.198	0.204	7.911	0.796	4.635	5.684	0.581	0.791
...	2996	0.327	34.075	0.262	0.047	8.490	0.953	7.494	4.297	0.918	0.959

...PACITY ANALYSIS WORKSHEET

...R	LN GROUP	v	s	v/s	g/C	c	v/c	CRITICAL
	LT-TH-RT	277	2906	0.10	0.19	554	0.50	
	LT-TH-RT	130	1194	0.11	0.19	228	0.57	*
	LT-TH-RT	1030	2542	0.41	0.71	1804	0.57	*
	LT-TH-RT	1138	3080	0.37	0.71	2185	0.52	

...CLE= 60.0 LOST= 6.0 SUM V/S CRIT= 0.51 TOTAL V/C= 0.57

...VEL OF SERVICE WORKSHEET

...R	LN GROUP	v/c	g/C	C	d1	c	d2	PF	Delay	LOS	Avg Q	95% Q
	LT-TH-RT	0.50	0.19	60.0	16.51	554	0.61	0.85	14.55	B	3.6	
	LT-TH-RT	0.57	0.19	60.0	16.76	228	2.52	0.85	16.39	C	1.8	
	LT-TH-RT	0.57	0.71	60.0	3.24	1804	0.33	0.85	3.03	A	4.8	
	LT-TH-RT	0.52	0.71	60.0	3.05	2185	0.19	0.85	2.75	A	5.2	

...R	Delay	LOS
	14.55	B
	16.39	C
	3.03	A
	2.75	A

...TERSECTION DELAY = 4.82 INTERSECTION LOS=A

...E CYCLE LENGTH WITHIN THE BOUNDS OF 60 TO 120 SECONDS
...ICH MINIMIZES CRITICAL MOVEMENT DELAY IS 60.0 SECONDS

...R A V/C RATIO OF .95 THE CYCLE SHOULD BE 13.1 SECONDS
...E EXISTING TIMING IS OPTIMAL

```
NCH PROGRAM VERSION DATE 2-6-1987
35 HCM - CHAPTER 9: SIGNALIZED - OPERATIONAL ANALYSIS
ACONESS HOSPITAL
OOKLINE/LONGWOOD/AM/EXISTING
te:08-03-1987                time:21:51:18
ST DATA SET NAMES LOADED OR SAVED
LUME=BRLWAME    GEOMETRICS=BRLGWD     SIGNAL=BRLGWD
CATED IN CBD:Y
LUME & GEOMETRICS
      VOLUMES        # OF LANES      LANE WIDTH      CROSS
R  LT   TH   RT     LT TH RT      LT   TH   RT     WALK
  134  189   21      0  2  0     0.0 12.0  0.0      0
   59  115   91      0  2  0     0.0 12.0  0.0      0
   25  773  168      0  2  0     0.0 12.0  0.0      0
  177  465  114      0  2  0     0.0 12.0  0.0      0

AFFIC & ROADWAY CONDITIONS
                ADJ PARK                    PEDESTRIANS          ARR
R GRADE %HV     Y/N MOVES BUSES  PHF CROSS BUT MIN TIME TYPE
  0.0% 0.0%     N      0     0  .900     0          7.0    3
  0.0% 0.0%     N      0     0  .900     0          7.0    3
  0.0% 0.0%     N      0     0  .900     0          7.0    3
  0.0% 0.0%     Y      5     0  .900     0          7.0    3

ASINGS
  EASTBOUND    WESTBOUND    NORTHBOUND   SOUTHBOUND  GREEN  Y+R PRE/ACT
  l  t  r  p   l  t  r  p   l  t  r  p   l  t  r  p
  *  *  *      *  *  *                                 7.6    3    A
                             *  *  *      *  *  *      26.4    3    A

CLE=  40.0

LUME ADJUSTMENT WORKSHEET
RT 1 (MOVEMENT ADJUSTMENTS)
R  LTV  THV  RTV   PHF  LTFR THFR RTFR
   134  189   21  .900   149  210   23
    59  115   91  .900    66  128  101
    25  773  168  .900    28  859  187
   177  465  114  .900   197  517  127

RT 2 (LANE GROUP ADJUSTMENTS)
R LN GROUP   FLOW N   LU     v  Plt  Prt
  LT-TH-RT    382 2 1.05  401 0.39 0.06
  LT-TH-RT    294 2 1.05  309 0.22 0.34
  LT-TH-RT   1073 2 1.05 1127 0.03 0.17
  LT-TH-RT    840 2 1.05  882 0.23 0.15

RT 3 (OPPOSING VOLUME ADJUSTMENTS)
FT TURN                  OPPOSING APPROACH
ING OPPOSED       VOLUMES       % OPPOSING LEFT TURN     # LANES      OPPOSING
                LT   TH   RT        LT   TH   RT        LT  TH  RT     VOLUME
STBOUND         66  128  101       100  100  100        0   2   0       294
STBOUND        149  210   23       100  100  100        0   2   0       382
RTHBOUND       197  517  127       100  100  100        0   2   0       840
```

...LEFT-TURN ADJUSTMENT WORKSHEET

R	LN GROUP	IDEAL	N	Fwid	Fhv	Fgr	Fpark	Fbus	Farea	Frt	Flt	s
	LT-TH-RT	1800	2	1.000	1.000	1.000	1.000	1.000	0.900	0.991	0.952	3055
	LT-TH-RT	1800	2	1.000	1.000	1.000	1.000	1.000	0.900	0.948	0.933	2867
	LT-TH-RT	1800	2	1.000	1.000	1.000	1.000	1.000	0.900	0.974	0.923	2911
	LT-TH-RT	1800	2	1.000	1.000	1.000	0.937	1.000	0.900	0.977	0.648	1923

PPLEMENTAL WORKSHEET FOR LEFT-TURN ADJUSTMENT FACTOR FLT

PUT VARIABLES

F	C	G	N	Va	Vm	Vlt	Plt	No	Vo	Plto
	40	8	2	382	382	149	0.39	2	294	0.22
	40	8	2	294	294	66	0.22	2	382	0.39
	40	26	2	1073	1073	28	0.03	2	840	0.23
	40	26	2	840	840	197	0.23	2	1073	0.03

LCULATIONS

R	Sop	Yo	Gu	Fs	Pl	Gq	Pt	Gf	El	Fm	Flt
	3074	0.096	4.137	0.691	0.790	3.435	0.210	0.494	1.628	0.903	0.952
	2892	0.132	2.634	0.636	0.496	4.938	0.504	1.660	1.769	0.866	0.933
	1751	0.480	13.913	0.350	0.099	12.514	0.901	8.726	3.214	0.845	0.923
	3405	0.315	20.180	0.204	0.952	6.248	0.048	0.101	5.510	0.296	0.648

PACITY ANALYSIS WORKSHEET

R	LN GROUP	v	s	v/s	g/C	c	v/c	CRITICAL
	LT-TH-RT	401	3055	0.13	0.19	578	0.69	*
	LT-TH-RT	309	2867	0.11	0.19	543	0.57	
	LT-TH-RT	1127	2911	0.39	0.66	1923	0.59	
	LT-TH-RT	882	1923	0.46	0.66	1270	0.69	*

CLE= 40.0 LOST= 6.0 SUM V/S CRIT= 0.59 TOTAL V/C= 0.69

VEL OF SERVICE WORKSHEET

R	LN GROUP	v/c	g/C	C	d1	c	d2	PF	Delay	LOS	Avg Q	95% Q
	LT-TH-RT	0.69	0.19	40.0	11.50	578	2.49	0.85	11.89	B	3.4	
	LT-TH-RT	0.57	0.19	40.0	11.20	543	1.07	0.85	10.43	B	2.7	
	LT-TH-RT	0.59	0.66	40.0	2.86	1923	0.35	0.85	2.72	A	4.0	
	LT-TH-RT	0.69	0.66	40.0	3.23	1270	1.17	0.85	3.74	A	3.2	

Delay	LOS
11.89	B
10.43	B
2.72	A
3.74	A

ERSECTION DELAY = 5.28 INTERSECTION LOS=B

CYCLE LENGTH WITHIN THE BOUNDS OF 40 TO 120 SECONDS
CH MINIMIZES CRITICAL MOVEMENT DELAY IS 40.0 SECONDS

A V/C RATIO OF .95 THE CYCLE SHOULD BE 15.8 SECONDS
EXISTING TIMING IS OPTIMAL

INCH PROGRAM VERSION DATE 2-6-1987
985 HCM - CHAPTER 9: SIGNALIZED - OPERATIONAL ANALYSIS
EACONESS HOSPITAL
ROOKLINE/LONGWOOD/AM/EXISTING+PROJECT
ate:08-03-1987 time:21:54:44
AST DATA SET NAMES LOADED OR SAVED
OLUME=BRLWAMEP GEOMETRICS=BRLGWD SIGNAL=BRLGWD
OCATED IN CBD:Y

OLUME & GEOMETRICS

	VOLUMES			# OF LANES			LANE WIDTH			CROSS
ER	LT	TH	RT	LT	TH	RT	LT	TH	RT	WALK
3	134	189	21	0	2	0	0.0	12.0	0.0	0
3	59	115	91	0	2	0	0.0	12.0	0.0	0
3	5	773	168	0	2	0	0.0	12.0	0.0	0
3	177	477	102	0	2	0	0.0	12.0	0.0	0

RAFFIC & ROADWAY CONDITIONS

			ADJ PARK			PEDESTRIANS			ARR
R	GRADE	%HV	Y/N	MOVES	BUSES	PHF	CROSS	BUT MIN TIME	TYPE
	0.0%	0.0%	N	0	0	.900	0	7.0	3
3	0.0%	0.0%	N	0	0	.900	0	7.0	3
	0.0%	0.0%	N	0	0	.900	0	7.0	3
	0.0%	0.0%	Y	5	0	.900	0	7.0	3

ASINGS

EASTBOUND				WESTBOUND				NORTHBOUND				SOUTHBOUND				GREEN	Y+R	PRE/ACT
l	t	r	p	l	t	r	p	l	t	r	p	l	t	r	p			
*	*	*		*	*	*										7.7	3	A
								*	*	*		*	*	*		26.3	3	A

CLE= 40.0

LUME ADJUSTMENT WORKSHEET
RT 1 (MOVEMENT ADJUSTMENTS)

R	LTV	THV	RTV	PHF	LTFR	THFR	RTFR
	134	189	21	.900	149	210	23
	59	115	91	.900	66	128	101
	5	773	168	.900	6	859	187
	177	477	102	.900	197	530	113

RT 2 (LANE GROUP ADJUSTMENTS)

R	LN GROUP	FLOW	N	LU	v	Plt	Prt
	LT-TH-RT	382	2	1.05	401	0.39	0.06
	LT-TH-RT	294	2	1.05	309	0.22	0.34
	LT-TH-RT	1051	2	1.05	1104	0.01	0.18
	LT-TH-RT	840	2	1.05	882	0.23	0.13

RT 3 (OPPOSING VOLUME ADJUSTMENTS)

FT TURN	OPPOSING APPROACH								
ING OPPOSED	VOLUMES			% OPPOSING LEFT TURN			# LANES			OPPOSING
	LT	TH	RT	LT	TH	RT	LT	TH	RT	VOLUME
STBOUND	66	128	101	100	100	100	0	2	0	294
STBOUND	149	210	23	100	100	100	0	2	0	382
RTHBOUND	197	530	113	100	100	100	0	2	0	840
UTHBOUND	6	859	187	100	100	100	0	2	0	840

	LT-TH-RT	1800	2	1.000	1.000	1.000	1.000	1.000	0.900	0.991	0.950	3051
B	LT-TH-RT	1800	2	1.000	1.000	1.000	1.000	1.000	0.900	0.948	0.933	2866
F	LT-TH-RT	1800	2	1.000	1.000	1.000	1.000	1.000	0.900	0.973	1.000	3154
			2	1.000	1.000	1.000	0.937	1.000	0.900	0.980	0.657	1956

PPLEMENTAL WORKSHEET FOR LEFT-TURN ADJUSTMENT FACTOR FLT
PUT VARIABLES

R	C	G	N	Va	Vm	Vlt	Flt	No	Vo	Plto
	40	8	2	382	382	149	0.39	2	294	0.22
	40	8	2	294	294	66	0.22	2	382	0.39
	40	26	2	1051	1051	6	0.01	2	840	0.23
	40	26	2	840	840	197	0.23	2	1051	0.01

CULATIONS

Sop	Yo	Gu	Fs	Pl	Gq	Pt	Gf	El	Fm	Flt
3074	0.096	4.244	0.691	0.791	3.425	0.209	0.491	1.628	0.901	0.950
2892	0.132	2.746	0.636	0.496	4.923	0.504	1.656	1.769	0.865	0.933
1824	0.461	14.661	0.350	0.020	11.670	0.980	10.907	3.214	1.000	1.000
3558	0.295	20.601	0.218	0.920	5.730	0.080	0.174	5.159	0.315	0.657

CITY ANALYSIS WORKSHEET

LN GROUP	V	S	V/S	g/C	C	V/C	CRITICAL
LT-TH-RT	401	3051	0.13	0.19	585	0.69	
T-TH-RT	309	2866	0.11	0.19	550	0.56	*
T-TH-RT	1104	3154	0.35	0.66	2076	0.53	
T-TH-RT	882	1956	0.45	0.66	1287	0.69	*

= 40.0 LOST= 6.0 SUM V/S CRIT= 0.58 TOTAL V/C= 0.69

OF SERVICE WORKSHEET

GROUP	V/C	g/C	C	d1	c	d2	PF	Delay	LOS	Avg Q	95% Q
-TH-RT	0.69	0.19	40.0	11.43	585	2.33	0.85	11.70	B	3.4	
-TH-RT	0.56	0.19	40.0	11.13	550	1.00	0.85	10.32	B	2.6	
-TH-RT	0.53	0.66	40.0	2.73	2076	0.21	0.85	2.50	A	4.0	
TH-RT	0.69	0.66	40.0	3.23	1287	1.08	0.85	3.66	A	3.2	

ay	LOS
70	B
32	B
50	A
6	A

TION DELAY = 5.15 INTERSECTION LOS=B

E LENGTH WITHIN THE BOUNDS OF 40 TO 120 SECONDS
NIMIZES CRITICAL MOVEMENT DELAY IS 40.0 SECONDS

RATIO OF .95 THE CYCLE SHOULD BE 15.5 SECONDS
ING TIMING IS OPTIMAL

```
INCH PROGRAM VERSION DATE 2-6-1987
985 HCM - CHAPTER 9: SIGNALIZED - OPERATIONAL ANALYSIS
EACONESS HOSPITAL
ROOKLINE/LONGWOOD/PM/EXISTING
ate:08-03-1987                    time:22:10:07
AST DATA SET NAMES LOADED OR SAVED
OLUME=BRLWPME     GEOMETRICS=BRLGWD      SIGNAL=BRLGWD
OCATED IN CBD:Y
OLUME & GEOMETRICS
         VOLUMES        # OF LANES      LANE WIDTH       CROSS
IR   LT    TH    RT     LT TH RT     LT    TH    RT      WALK
B    58   194    21      0  2  0    0.0  12.0   0.0       0
B   170   217   151      0  2  0    0.0  12.0   0.0       0
B    50   738   121      0  2  0    0.0  12.0   0.0       0
B   168   764   106      0  2  0    0.0  12.0   0.0       0

RAFFIC & ROADWAY CONDITIONS
                  ADJ PARK                    PEDESTRIANS          ARR
IR GRADE  %HV     Y/N MOVES BUSES   PHF  CROSS BUT MIN TIME TYPE
B  0.0%   0.0%     N     0     0   .900     0          7.0    3
B  0.0%   0.0%     N     0     0   .900     0          7.0    3
B  0.0%   0.0%     N     0     0   .900     0          7.0    3
B  0.0%   0.0%     Y     5     0   .900     0          7.0    3

HASINGS
    EASTBOUND    WESTBOUND    NORTHBOUND   SOUTHBOUND  GREEN  Y+R PRE/ACT
    l  t  r  p   l  t  r  p   l  t  r  p   l  t  r  p
1   *  *  *      *  *  *                                19.7   3     A
2                             *  *  *      *  *  *      51.3   3     A

YCLE=  77.0

OLUME ADJUSTMENT WORKSHEET
ART 1 (MOVEMENT ADJUSTMENTS)
IR   LTV   THV   RTV    PHF   LTFR  THFR  RTFR
B     58   194    21   .900     64   216    23
B    170   217   151   .900    189   241   168
B     50   738   121   .900     56   820   134
B    168   764   106   .900    187   849   118

ART 2 (LANE GROUP ADJUSTMENTS)
IR LN GROUP  FLOW N   LU     v   Plt   Prt
B  LT-TH-RT   303 2 1.05   319 0.21  0.08
B  LT-TH-RT   598 2 1.05   628 0.32  0.28
B  LT-TH-RT  1010 2 1.05  1061 0.06  0.13
B  LT-TH-RT  1153 2 1.05  1211 0.16  0.10

ART 3 (OPPOSING VOLUME ADJUSTMENTS)
EFT TURN                  OPPOSING APPROACH
EING OPPOSED        VOLUMES       % OPPOSING LEFT TURN     # LANES      OPPOSING
                  LT   TH   RT       LT   TH   RT       LT  TH  RT      VOLUME
ASTBOUND         189  241  168      100  100  100        0   2   0        598
ESTBOUND          64  216   23      100  100  100        0   2   0        303
ORTHBOUND        187  849  118      100  100  100        0   2   0       1153
OUTHBOUND         56  820  134      100  100  100        0   2   0       1211
```

SATURATION FLOW ADJUSTMENT WORKSHEET

IR	LN GROUP	IDEAL	N	Fwid	Fhv	Fgr	Fpark	Fbus	Farea	Frt	Flt	s
B	LT-TH-RT	1800	2	1.000	1.000	1.000	1.000	1.000	0.900	0.988	0.673	2155
B	LT-TH-RT	1800	2	1.000	1.000	1.000	1.000	1.000	0.900	0.958	0.822	2550
B	LT-TH-RT	1800	2	1.000	1.000	1.000	1.000	1.000	0.900	0.980	0.627	1990
B	LT-TH-RT	1800	2	1.000	1.000	1.000	0.937	1.000	0.900	0.985	0.630	1885

UPPLEMENTAL WORKSHEET FOR LEFT-TURN ADJUSTMENT FACTOR FLT

NPUT VARIABLES

IR	C	G	N	Va	Vm	Vlt	Plt	No	Vo	Plto
B	77	20	2	303	303	64	0.21	2	598	0.32
B	77	20	2	598	598	189	0.32	2	303	0.21
B	77	51	2	1010	1010	56	0.06	2	1153	0.16
B	77	51	2	1153	1153	187	0.16	2	1010	0.06

ALCULATIONS

IR	Sop	Yo	Gu	Fs	Pl	Gq	Pt	Gf	El	Fm	Flt
B	2993	0.200	5.357	0.501	0.794	14.307	0.206	0.519	2.244	0.346	0.673
B	2848	0.107	12.828	0.685	0.783	6.836	0.217	0.550	1.641	0.644	0.822
B	2271	0.508	24.955	0.154	0.394	26.481	0.606	3.073	7.297	0.253	0.627
B	2674	0.378	35.757	0.244	0.791	15.579	0.209	0.530	4.615	0.261	0.630

APACITY ANALYSIS WORKSHEET

IR	LN GROUP	v	s	v/s	g/C	c	v/c	CRITICAL
B	LT-TH-RT	319	2155	0.15	0.26	550	0.58	
B	LT-TH-RT	628	2550	0.25	0.26	651	0.96	*
B	LT-TH-RT	1061	1990	0.53	0.67	1327	0.80	
B	LT-TH-RT	1211	1885	0.64	0.67	1257	0.96	*

YCLE= 77.0 LOST= 6.0 SUM V/S CRIT= 0.89 TOTAL V/C= 0.96

EVEL OF SERVICE WORKSHEET

IR	LN GROUP	v/c	g/C	C	d1	c	d2	PF	Delay	LOS	Avg Q	95% Q
B	LT-TH-RT	0.58	0.26	77.0	19.04	550	1.13	0.85	17.14	C	4.8	
B	LT-TH-RT	0.96	0.26	77.0	21.52	651	19.56	0.85	34.92	D	10.6	
B	LT-TH-RT	0.80	0.67	77.0	6.96	1327	2.51	0.85	8.05	B	7.2	
B	LT-TH-RT	0.96	0.67	77.0	9.09	1257	12.90	0.85	18.70	C	10.1	

IR	Delay	LOS
B	17.14	C
B	34.92	D
B	8.05	B
B	18.70	C

NTERSECTION DELAY = 18.20 INTERSECTION LOS=C

HE CYCLE LENGTH WITHIN THE BOUNDS OF 40 TO 120 SECONDS
HICH MINIMIZES CRITICAL MOVEMENT DELAY IS 77.0 SECONDS

OR A V/C RATIO OF .95 THE CYCLE SHOULD BE 92.9 SECONDS
HE EXISTING TIMING IS OPTIMAL

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INCH PROGRAM VERSION DATE 2-6-1987
985 HCM - CHAPTER 9: SIGNALIZED - OPERATIONAL ANALYSIS
ACONESS HOSPITAL
ROOKLINE/LONGWOOD/PM/EXISTING+PROJECT
ate:08-03-1987                    time:22:14:02
IST DATA SET NAMES LOADED OR SAVED
OLUME=BRLWPMEP   GEOMETRICS=BRLGWD      SIGNAL=BRLGWD
OCATED IN CBD:Y
OLUME & GEOMETRICS
        VOLUMES          # OF LANES      LANE WIDTH       CROSS
R   LT    TH    RT      LT TH RT      LT    TH    RT      WALK
     58   194    21      0  2  0     0.0  12.0   0.0       0
    170   217   151      0  2  0     0.0  12.0   0.0       0
     50   738   121      0  2  0     0.0  12.0   0.0       0
    168   784    86      0  2  0     0.0  12.0   0.0       0

AFFIC & ROADWAY CONDITIONS
                ADJ PARK                    PEDESTRIANS          ARR
R GRADE %HV     Y/N MOVES BUSES  PHF  CROSS BUT MIN TIME  TYPE
  0.0%  0.0%    N     0     0    .900    0          7.0     3
  0.0%  0.0%    N     0     0    .900    0          7.0     3
  0.0%  0.0%    N     0     0    .900    0          7.0     3
  0.0%  0.0%    Y     5     0    .900    0          7.0     3

ASINGS
   EASTBOUND    WESTBOUND    NORTHBOUND   SOUTHBOUND  GREEN  Y+R  PRE/ACT
   l  t  r  p   l  t  r  p   l  t  r  p   l  t  r  p
   *  *  *      *  *  *
                                                      19.7   3    A
                           *  *  *         *  *  *     51.3   3    A

CLE=  77.0

LUME ADJUSTMENT WORKSHEET
RT 1 (MOVEMENT ADJUSTMENTS)
R   LTV   THV   RTV    PHF   LTFR  THFR  RTFR
     58   194    21   .900    64   216    23
    170   217   151   .900   189   241   168
     50   738   121   .900    56   820   134
    168   784    86   .900   187   871    96

RT 2 (LANE GROUP ADJUSTMENTS)
N LN GROUP   FLOW N   LU     v    Plt   Prt
  LT-TH-RT    303 2 1.05   319 0.21  0.08
  LT-TH-RT    598 2 1.05   628 0.32  0.28
  LT-TH-RT   1010 2 1.05  1061 0.06  0.13
  LT-TH-RT   1153 2 1.05  1211 0.16  0.08

RT 3 (OPPOSING VOLUME ADJUSTMENTS)
FT TURN                OPPOSING APPROACH
ING OPPOSED        VOLUMES        % OPPOSING LEFT TURN     # LANES      OPPOSING
                LT    TH    RT      LT    TH    RT      LT  TH  RT      VOLUME
STBOUND        189   241   168     100   100   100      0   2   0        598
STBOUND         64   216    23     100   100   100      0   2   0        303
RTHBOUND       187   871    96     100   100   100      0   2   0       1153
ITHBOUND        56   820   134     100   100   100
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...RATION FLOW ADJUSTMENT WORKSHEET

IR	LN GROUP	IDEAL	N	Fwid	Fhv	Fgr	Fpark	Fbus	Farea	Frt	Flt	s
3	LT-TH-RT	1800	2	1.000	1.000	1.000	1.000	1.000	0.900	0.988	0.673	2156
8	LT-TH-RT	1800	2	1.000	1.000	1.000	1.000	1.000	0.900	0.958	0.822	2551
8	LT-TH-RT	1800	2	1.000	1.000	1.000	1.000	1.000	0.900	0.980	0.626	1989
8	LT-TH-RT	1800	2	1.000	1.000	1.000	0.937	1.000	0.900	0.988	0.630	1890

UPPLEMENTAL WORKSHEET FOR LEFT-TURN ADJUSTMENT FACTOR FLT

NPUT VARIABLES

IR	C	G	N	Va	Vm	Vlt	Plt	No	Vo	Plto
3	77	20	2	303	303	64	0.21	2	598	0.32
3	77	20	2	598	598	189	0.32	2	303	0.21
3	77	51	2	1010	1010	56	0.06	2	1153	0.16
3	77	51	2	1153	1153	187	0.16	2	1010	0.06

ALCULATIONS

IR	Sop	Yo	Gu	Fs	Pl	Gq	Pt	Gf	El	Fm	Flt
3	2993	0.200	5.408	0.501	0.793	14.297	0.207	0.522	2.244	0.347	0.673
3	2848	0.107	12.873	0.685	0.783	6.831	0.217	0.550	1.641	0.644	0.822
3	2271	0.508	24.773	0.154	0.394	26.523	0.606	3.070	7.297	0.253	0.626
4	2674	0.378	35.692	0.244	0.791	15.604	0.209	0.529	4.615	0.260	0.630

APACITY ANALYSIS WORKSHEET

IR	LN GROUP	v	s	v/s	g/C	c	v/c	CRITICAL
3	LT-TH-RT	319	2156	0.15	0.26	552	0.58	
8	LT-TH-RT	628	2551	0.25	0.26	653	0.96	*
2	LT-TH-RT	1061	1989	0.53	0.67	1325	0.80	
4	LT-TH-RT	1211	1890	0.64	0.67	1259	0.96	*

'CLE= 77.0 LOST= 6.0 SUM V/S CRIT= 0.89 TOTAL V/C= 0.96

VEL OF SERVICE WORKSHEET

R	LN GROUP	v/c	g/C	C	d1	c	d2	PF	Delay	LOS	Avg Q	95% Q
	LT-TH-RT	0.58	0.26	77.0	19.01	552	1.11	0.85	17.10	C	4.8	
	LT-TH-RT	0.96	0.26	77.0	21.49	653	19.16	0.85	34.55	D	10.5	
	LT-TH-RT	0.80	0.67	77.0	6.98	1325	2.54	0.85	8.09	B	7.2	
	LT-TH-RT	0.96	0.67	77.0	9.08	1259	12.61	0.85	18.43	C	10.0	

R	Delay	LOS
	17.10	C
	34.55	D
	8.09	B
	18.43	C

Property of
BOSTON REDEV[illegible] AUTHORITY

TERSECTION DELAY = 18.04 INTERSECTION LOS=C

E CYCLE LENGTH WITHIN THE BOUNDS OF 40 TO 120 SECONDS
ICH MINIMIZES CRITICAL MOVEMENT DELAY IS 77.0 SECONDS

R A V/C RATIO OF .95 THE CYCLE SHOULD BE 90.2 SECONDS
E EXISTING TIMING IS OPTIMAL

5053